APPENDIX I

APPARENT PERIODS OF PULSARS

For most of the pulsars their periods have been measured quite accurately. Such measured values of the periods have been compiled by Manchester and Taylor(1980) [94]. These periods are with respect to the arrival times at the Barycentre of the Solar System (BSS), and hold good at the epoch of measurement. At any other point of time, the apparent periodicities as observed on the Earth are, in principle, different than those quoted in the literature. This is so, mainly due to the secular variation in the periods and due to the motion of the Earth about the BSS. The apparent periods can also be affected by the Earth's rotation around its own axis. However, the last factor does not cause large changes in the periods when the pulsar is observed close to the meridian. Here, we briefly describe the major corrections that should be applied to the quoted period to compute a required apparent period.

Let Po be the period of a pulsar as would be observed at the BSS at an epoch t_o. To first order, the period P1 at any given epoch t1 can be written as

$$P1 = Po + (t1 - t_o)\dot{P} \qquad .....(I.1)$$

Where $\dot{P}$ = the first derivative of the period.

The above correction term is due to the secular variation of the period related to the slowing-down of pulsars. If there are any sudden changes in the period, called glitches, then they have to be incorporated separately.

The apparent period at an observatory on the Earth can now be computed as follows. Let $\vec{V}_E = (V_x, V_y, V_z)$ be a velocity vector representing the velocity of the geocentre with respect to the BSS. Let $\vec{V}_{obs}$ be the velocity of the observatory with respect to the geocentre, and $\vec{r}$ be a unit vector along the line of sight: to the pulsar. The projected velocity (V_d) of the observatory in the direction of the pulsar is given by

$$V_d = \vec{r} \cdot (\vec{V}_E + \vec{V}_{obs}) \qquad \text{.....(I.2)}$$

where V_d = the doppler velocity

and " . " means the dot product of vectors.

The contribution of the product $(\vec{r}.\vec{V}_{obs})$ can be ignored if the line of sight is close to the local meridian. Now the appropriate projected velocity can be written as

$$V_d = COS(\delta).[Vx.COS(RA)+Vy.SIN(RA)]+Vz.Sin(\delta) \quad .....(I.3)$$

where RA = Right Ascension of the pulsar

and δ = declination of the pulsar.

Due to this Doppler effect the period P1 will appear to an observer on the Earth as

$$P = P1\ (1 - V_d/c) \quad .....(I.4)$$

where P = the apparent period

c = the velocity of light

The apparent periods computed this way are accurate enough for the present purpose. However, in certain observations the terms ignored above may become significant.

APPENDIX 11

PROPAGATION EFFECTS IN THE INTERSTELLAR MEDIUM

A variety of effects in the interstellar medium (ISM) [104] cause distortion of the signals passing through the medium. Many of these effects are only observable in the case of pulsar signals. Hence, pulsar signals are considered as very important probes for studying the properties of the medium. However, the study of intrinsic radiation from pulsars itself becomes difficult in the presence of the propagation effects. Here, we briefly describe only those effects that are relavent to the present work.

i) Dispersion in the interstellar medium:

This effect occurs due to the presence of free electrons in the ISM. From the theory of wave propagation in plasma, we know that the group velocity (V_g) of a wave travelling in a homogeneous isotropic medium is given by

$$V_g = c\,[1 - (\omega_p/\omega)^2]^{1/2} \qquad \text{.....(II.1)}$$

where ω_p = the plasma frequency

ω = the wave frequency

and c = the velocity of light.

The Plasma frequency is given by

$$\omega_p = (4\pi n_e e^2/m)^{1/2} \qquad \text{....(II.2)}$$

where n_e = the electron density

e = the charge of an electron

m = the mass of an electron.

Thus, in the presence of plasma in the ISM, the group velocity of radio waves is slightly less than the velocity of light and is a function of the wave frequency and the electron densitv in the medium.

For continuous signals, the effects due to the reduced velocity are not observable. However, due to the pulsed nature of the pulsar radiation, the difference in the pulse arrival times at two different frequencies becomes observable. Let fl and f2 be two different radio frequencies in Hz at which the pulse arrival times are tl and t2 respectively. Then the difference in the pulse arrival times can be written using eq.(II.1), as

$$t2 - t1 \simeq \frac{e^2}{2\pi mc} [(f2)^{-2} - (f1)^{-2}] \int_0^d n_e \, dl \qquad \text{....(II.3)}$$

where $\omega_p \ll 2\pi f1, 2\pi f2$

and d = the distance to the pulsar.

This equation can be rewritten in the following form.

$$t2 - t1 \simeq \frac{DPI}{2.410 \times 10^{-16}} [(f2)^{-2} - (f1)^{-2}] \qquad \ldots.(II.4)$$

where $DM = \int_0^d n_e \, dl$

= Dispersion Measure in cm^{-3} pc

d is in parsec

and t is in seconds.

If we assume that $|f2 - f1| \ll f1$ and f2, then eq. (II.4) can be further simplified to give

$$\Delta t = \frac{DM \ \Delta F}{1.205 \times 10^{-16} \ f_o^3} \qquad \ldots.(II.5)$$

where $\Delta t = t2 - t1$

$\Delta F = f2 - f1$

and $f_o = \sqrt{f1f2} \simeq (f1 + f2)/2$

Thus, if pulsar signals are observed with a receiver channel bandwidth equal to ΔF around a centre frequency f_o, then the pulses will be smeared by an amount Δt.

ii) Faraday Rotation

In the presence of even the weak magnetic fields in interstellar space, an effect known as Faraday rotation becomes important. In this effect, the plane of polarization of a linearly polarized wave rotates along the propagatioc path. The angle of rotation after traversal of a path d is

$$\Delta\Psi = \frac{2\pi e^3}{(m c \omega)^2} \int_0^d n_e B_o \cos\theta \, dl \qquad \text{....(II.6)}$$

where B_o = the magentic flux density

θ = the angle between the line of sight and the direction of the interstellar magnetic field.

The rotation measure (RM) is then defined by

$$\Delta\Psi = RM \lambda^2. \qquad \text{....(II.7)}$$

So that

$$RM = \frac{e^3}{2\pi m^2 c^4} \int_0^d n_e B_o \cos\theta \, dl \qquad \text{....(II.8)}$$

The rotation measure is +ve for fields directed towards the observer an -ve for fields directed away.

The mean line of sight component of the magnetic field is given by

$$\langle B \cos\theta \rangle = \frac{\int_0^d n_e B_o \cos\theta \, dl}{\int_0^d n_e \, dl}$$

$$= 1.232 \; (RM/DM) \qquad \text{....(II.9)}$$

where B_o is in microgauss

RM is in rad m^{-2}

and DM in cm^{-3} pc.

It should be noted, that for a given value of RM, the angle of rotation is a function of the observing wavelength. Therefore, if we observrve over a bandwidth ΔF around a centre frequency f_o, such that $f_o >> \Delta F$, the angles of rotation for the extreme frequencies within the band O F differ by an amount $\delta\psi$, given by

$$\delta\psi \simeq \frac{2\ RM\ c^2\ \Delta F}{f_o^3} \qquad \ldots(II.10)$$

Hence,for studying the polarization characteristics, the receiver channel bandwidths should be narrow enough, so that the intrinsic characteristics are not smeared much. However, due the effects of the Faraday rotaion, it becomes possible to effectively rotate the relative polarization of a receiving antenna by changing the observing frequency by appropriate amounts (e.g.[81]).

iii) Scattering and scintillations:

The insterstellar scattering is caused by small fluctuations in the interstellar electron density. For a medium having electron density fluctuations Δn_e, with characteristic scale size a, both of which may be functions of distance d along the line of sight, a plane wave from a distant point source is scattered through a range of angles θ_s having an r.m.s. value θ r.m.s. given approximatley by [104]

$$\theta r.m.s. \approx r_o (\lambda^2 / 2\pi) (d/a)^{1/2} \Delta n_e \qquad ...(II.11)$$

where r_o = the classical radius of the electron

$= 2.8 \times 10^{-13}$ cm

The apparent angular semidiameter, θo, of the source is equal to $(\theta r.m.s./2)$.

For a scattering medium situated a mean distance d/2 from the source, where d is the distance from the source to the observer, the scattered radiation at a small anyle (θ_s) is delayed with respect to the unscattered radiation by an amount

$$t \approx \frac{d \theta_s^2}{2c} \qquad ...(II.12)$$

Thus, in addition to the angular broadening, the scattering process causes time smearing of impulsive signals. For a Gaussihn distribution of irregularity sizes and hence a Gaussian distribution of scattering angles, the pulse shape is effectively convolved with a[a] truncated exponential

$$S(t) = \begin{cases} \exp(-t/\tau s) & t \geq 0 \\ 0 & t < 0 \end{cases} \qquad ...(II.13)$$

where τ_s = the characteristic width of the impulse response representing scattering in the ISM

$$= d\,\theta_0^2/c$$

This time smearing has a strong dependence on the frequency of radiation and the distance to the radiation source. Therefore, the scattering smearing becomes very significant for signals from distant pulsars at low radio frequencies.

Scintillations are caused by interference between the direct and scattered rays, which remain constructive only over a limited bandwidth. Sutton (1971) [71] has shown, that if $\Delta\nu$ is defined to be the frequency separation at which the correlation coefficient of observed intensity fluctuations drops to 0.5, then

$$\Delta\nu = \frac{1}{2\pi\tau_s} \qquad \ldots(\text{II.14})$$

The intensity fluctuations as a function of time, result from the passage of the telescope through the diffraction pattern formed by the screen of irregularities. Scintillation of a point source with a modulation index near unity (in a narrow frequency band) will occur provided that i) the scattering is strong, that is when the r.m.s. phase deviation **of rays,**

$$\Delta \phi > \pi \qquad \text{...(II.15)}$$

where

$$\Delta \phi \approx (d.a)^{1/2} \; r_o \Delta n_e \lambda \qquad \text{...(II.16)}$$

and ii) ***the*** scattering is multiple, so ***the observer*** sees rays from several scattering regions, i.e.,

$$d\theta_o \gg a \qquad \text{...(II.17)}$$

For strong scattering, the spatial scale of the diffraction pattern at the earth is

$$r_p \simeq \lambda / \theta_o \qquad \text{,..(II.18)}$$

So the decorrelation time for the fluctuations is approximately

$$\tau_d \simeq r_p / V_s \qquad \text{...(II.19)}$$

where, V_s is the velocity of the earth-pulsar line across the scattering screen.

APPENDIX III

DEFINITIONS

DEFINITIONS OF SOME TERMS USED IN ASTRONOMY.

(i) GENERAL[105]

(a) Great Circle: It is the circle drawn on the celestial sphere in a plane passing through the centre of the sphere.

(b) Meridian: The great circle passing through the zenith of the observer and the north and south points on his horizon.

(c) Celestial Equator: Circle at the intersection of the plane of the earth's equator and the celestial sphere,

(d) Declination (δ): Angle between celestial equator and the object.

(e) Vernal Equinox: The celestial equator and the great circle through ecliptic intersect in two points. These paints are called equinoxes. One of them is called the vernal equinox and considered as a reference point in the sky. This is also called first point of Aries,

(f) Hour Circle: The great circle through the celestial poles and the object.

(g) Right Ascension (RA): The angle between the vernal equinox and the hour circle.

(h) Flux: Power received per unit collecting area per unit bandwidth ($W/m^2/Hz$).

(i) Spectral index: The power of the frequency to which the intensity at that frequency is proportional.

(j) Brightness temperature: The temperature that a blackbody would have to have to emit radiation of the observed intensity at a given wavelength.

(ii) PARTICULAR TO PULSAR SIGNALS

(a) Peak flux: Peak flux of a pulsar signal is the flux received at the peak of a pulse.

(b) Pulse energy: Energy received from a pulsar per unit collecting area per unit bandwidth in one period.

(c) Average flux: Ratio of the pulse energy to the period.

(d) Longitude (phase): The angular separation with respect to the main pulse position when the period is equivalent to 360°.

APPENDIX IV

THE SIGNAL-TO-NOISE RATIO OBTAINABLE IF COS AND SIN CORRELATIONS ARE SQUARED, ADDED AND SQUARE ROOTED

Here, we ex mine the effect on the final signal-to-noise ratio obtainable when the COS and the SIN correlation outputs are combined in a conventinal way by squaring, adding and taking the square root. Let us assume that A1 and A2 are two random variables representing the COS and SIN correlation outputs. Let A1 and A2 be expressed as

$$A1 = a1 + n1 \qquad \text{...(IV.1a)}$$

and

$$A2 = a2 + n2 \qquad \text{...(IV.1b)}$$

where $a1 = \langle A1 \rangle$; $a2 = \langle A2 \rangle$

$n1, n2$ = zero mean random noise process

and $\langle\ \rangle$ represents ensemble mean

We assume that the processes n1, n2 are two zero mean Gaussian noise processes which are uncorrelated, but have same value (say σ) of the standard deviation.

We define a random variable A3, as

$$A3 = (A1^2 + A2^2)^{1/2} \qquad \text{....(IV.2)}$$

Substituting the expression for A1 and A2 from eq.s (IV.1a,b), we get

$$A3 = ((a1+n1)^2 + (a2+n2)^2)^{1/2} \qquad \text{....(IV.3)}$$

In the absence of noise, i.e. when $\sigma=0$, the quantity A3 is equal to $(a1^2+a2^2)^{1/2}$ (=b say), which in fact is the quantity of interest to us. In the presence of noise, however, an estimate (A4) of b, is obtained as the difference between the value of A3 on the source and the average value of A3 off the source, as

$$A4 = A3(ON) - \langle A3(OFF) \rangle \qquad \text{....(IV.4)}$$

where A3(ON) = A3 when $b > 0$

A3(OFF) = A3 when $b=0$

Thus

$$A3(OFF) = (n1^2 + n2^2)^{1/2} \qquad \text{....(IV.5)}$$

It can be shown that

$$\langle A3(OFF)\rangle = x\,\sigma \qquad \text{....(IV.6)}$$

where X = a constant with its value close to unity.

Therefore, A4, the estimate of b, can be expressed as

$$A4 = ((a1+n1)^2 + (a2+n2)^2)^{1/2} - x\,\sigma \qquad \text{....(IV.7)}$$

If σ_N represents the standard deviation of A4 from its true value b, then

$$\sigma_N^2 = \langle [A4 - b]^2 \rangle \qquad \text{....(IV.8)}$$

After substituting the value of A4 from eq.(IV.7) and rearranging, we get

$$\sigma_N^2 = \langle (b \left[1+2\,\frac{a1n1+a2n2}{b^2} + \frac{n1^2+n2^2}{b} \right]^{1/2} - x\,\sigma - b)^2 \rangle \qquad \text{.. (IV.9)}$$

Assuming, that $b \gg \sigma$, the above equation can simplified as :

$$\sigma_N^2 = \langle [b^{-1}(a1n1+a2n2+\frac{(n1^2+n2^2)}{2}) - x\,\sigma]^2 \rangle \qquad ...(IV.10)$$

Solving the above equation further, we find

$$\sigma_N^2 = b^{-2}[a1^2\langle n1^2\rangle + a2^2\langle n2^2\rangle + 2a1a2\langle n1n2\rangle$$
$$+a1\langle n1n2^2\rangle + a2\langle n1^2 n2\rangle + \langle n1^2 n2^2\rangle/2$$
$$+a1\langle n1^3\rangle + a2\langle n2^3\rangle + \langle n1^4\rangle/4 + \langle n2^4\rangle/4]$$
$$-2\,x\,\sigma\,b^{-1}[a1\langle n1\rangle + a2\langle n2\rangle + \langle n1^2\rangle/2 + \langle n2^2\rangle/2]$$
$$+ x^2\sigma^2 \qquad ...(IV.11)$$

As n1, n2 are two zero mean Gaussian processes which are uncorrelated, we can write the following propertities.

$$\langle n1\rangle = 0 \qquad ..(IV.12a)$$

$$\langle n2\rangle = 0 \qquad ..(IV.12b)$$

$$\langle n1^2\rangle = \sigma^2 \qquad ..(IV.12c)$$

$$\langle n2^2\rangle = \sigma^2 \qquad ..(IV.12d)$$

$$\langle n1n2\rangle = \langle n1\rangle\langle n2\rangle = 0 \qquad ..(IV.12e)$$

$$\langle n1^3 \rangle = 0 \qquad ..(IV.12f)$$

$$\langle n2^3 \rangle = 0 \qquad ..(IV.12g)$$

$$\langle n1 n2^2 \rangle = \langle n1 \rangle \langle n2^2 \rangle = 0 \qquad ..(IV.12h)$$

$$\langle n1^2 n2 \rangle = \langle n1^2 \rangle \langle n2 \rangle = 0 \qquad ..(IV.12i)$$

$$\langle n1^4 \rangle = 3\sigma^4 \qquad ..(IV.12j)$$

$$\langle n2^4 \rangle = 3\sigma^4 \qquad ..(IV.12k)$$

$$\langle n1^2 n2^2 \rangle = \langle n1^2 \rangle \langle n2^2 \rangle = \sigma^4 \qquad ..(IV.12l)$$

Using the above properties, eq.(IV.11) can be simplified to

$$\sigma_N^2 = b^{-2} (\sigma^2 b^2 + 2\sigma^4) - 2 x \sigma^3 b^{-1} + x^2 \sigma^2 \qquad ...(IV.13)$$

Hence,

$$\sigma_N = \sigma \left[(1 + x^2) + \frac{2\sigma^2}{b} - \frac{2 x \sigma}{b} \right]^{1/2} \qquad ...(IV.14)$$

As $\sigma \ll b$, we can ignore the all terms with σ/b and write

$$\sigma_N \simeq \sigma\sqrt{1+x^2} \qquad \ldots(IV.15)$$

Now, let us consider a case where $a1 > a2$ and $\sigma \ll b$, then the signal-to-noise ratios for A1 and A2 are

$$(S/N)_{A1} = a1/\sigma \qquad ..(IV.16a)$$

$$(S/N)_{A2} = a2/\sigma \qquad ..(IV.16b)$$

and

$$(S/N)_{A1} > (S/N)_{A2} \qquad ..(IV.16c)$$

If A1 and A2 are combined as given by eq.(IV.2), then the signal-to-noise ratio obtained can be shown to be

$$(S/N)o = b/\sigma_N$$

$$= \frac{\sqrt{a1^2+a2^2}}{\sqrt{2}\,\sigma} \qquad \ldots(IV.17)$$

and

$$(S/N)o < a1/\sigma = (S/N)_{A1} \qquad \ldots(IV.18)$$

The above result clearly shows that if the COS and SIN channel outputs are combined as. discussed here, the output signal-to-noise ratio is always worse than that in the individual channel with better signal-to-noise ratio.

APPENDIX V

OPTIMUM COMBINATION OF TWO INDEPENDENT ESTIMATES

Here, we derive the conditions under which two independent estimates of a quantity can be combined to obtain a new estimate with minimum possible error.

Let us say, that Ao1 and Ao2 are two independent estimates of a quantity, with root mean square error of $\sigma 1$ and $\sigma 2$ respectively. Let Ao be a new estimate, defined as a weighted mean of Ao1 and Ao2. Then

$$Ao = \frac{Ao1\ W1 + Ao2\ W2}{W1 + W2} \qquad \ldots(V.1)$$

where Wi = the weight for Aoi

It can be shown, that the root mean square error (σo), in the new estimate (Ao) can be expressed as

$$\sigma o^2 = [\,(W1.\sigma 1)^2 + (W2.\sigma 2)^2\,]/(W1+W2)^2 \qquad \ldots.(V.2)$$

We need to find suitable weights 111, W2, such that σo is minimized. Therefore we need the following conditions to be satisfied.

$$\frac{\partial(\sigma o^2)}{\partial W1} = 0 \qquad \text{...(V.3a)}$$

and

$$\frac{\partial(\sigma o^2)}{\partial W2} = 0 \qquad \text{...(V.3b)}$$

Assuming that W1,W2 are non zero finite values, the above equtions can be shown to result in the following condition.

$$W1.\sigma 1^2 = W2.\sigma 2^2 \qquad \text{....(V.4)}$$

$$= K_o \text{ say.}$$

where K_o is a constant $\neq 0$

Thus, by choosing $K_o = 1$ for simplicity, we find

$$W1 = (1/\sigma 1)^2 \qquad \text{...(V.5a)}$$

and

$$W2 = (1/\sigma 2)^2 \qquad \text{...(V.5b)}$$

Substituting these values in eq. (V.2), we yet

$$\sigma_o = \sigma_1\sigma_2 / (\sigma_1^2 + \sigma_2^2)^{1/2} \qquad \text{....(V.6)}$$

The output signal-to-noise ratio then can be expressed as

$$(S/N)_{Ao} = \frac{Ao}{\sigma_o}$$

$$= \frac{\sigma_2^2.Ao1 + \sigma_1^2.Ao2}{\sigma_1\sigma_2.(\sigma_1^2 + \sigma_2^2)^{1/2}} \qquad \text{....(V.7)}$$

This equation can also be written differently as

$$(S/N)_{Ao} = \frac{(S/N)_{Ao1}\,\sigma_2 + (S/N)_{Ao2}\,\sigma_1}{(\sigma_1^2 + \sigma_2^2)^{1/2}} \qquad \text{....(V.8)}$$

where $(S/N)_{Aoi}$ is the signal-to-noise ratio for Aoi

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SUMMARY

THE DETECTION AND PROCESSING OF PULSAR SIGNALS AT DECAMETRIC WAVELENGTHS.

The present day understanding of "pulsars" is based on extensive observational data obtained from over 400 pulsars. However, as most of these observations were made at frequencies above 100 MHz, the behaviour of pulsars at decametric wavelengths is still poorly known. So far, only a very few pulsars out of the more than 400 known have been detected at frequencies below 60 MHz. These limited low frequency observations have suggested that more such observations are of great importance for a better understanding of the physical processes that cause the observed radiation from pulsars. Therefore, at low radio frequencies, further observations on as many pulsars as possible are required.

It is, however, extremely difficult to observe pulsars with a good signal-to-noise ratio and high time-resolution at frequencies below 60 MHz. These difficulties arise due to scattering, dispersion, scintillations and Faraday rotation in the intervening interstellar medium. Further, the bright sky background at frequencies below 100 MHz, and

the often reduced strength of pulsar signals at the lowest frequencies observed demand extremely high system sensitivity for such observations.

Our aim, in the course of the present work, was to obtain observations of as many pulsars as possible with high sensitivity and high time-resolution at a low radin frequency. The Decameter-wave Radio Telescope at Gauribidanur, India, designed and used for continuum observations at 34.5 MHz was used for this purpose. This me'ridiantransit instrument consists of a "T" shaped array antenna and has a collecting area of 16000 sq.meters and an angular resolution of 26'X40'sec(Z) arc, where Z is the zenith-angle of the source. A brief description of the existing telescope system is presented and its capabilities in the context of pulsar observations are discussed.

The main limitation of the telescope system, as it existed, was its poor sensitivity for pulsar observations. The required sensitivity improvement was achieved by increasing the observing time per day on any source by a factor of $\sim$ 25. For this pu.pose, a tracking system was designed, fabricated and installed. This system enabled observation of a source for 42 sec (δ) min. in a day, where δ is the declination of the source. This increase in the observation time led to an improvement in the sensitivity by a factor of $\sim$ 5 . A detailed description of the tracking system is presented in the first part of the thesis.

In the second part, a scheme for observations of strong but not highly dispersed pulsar signals is presented. This scheme used the already existing single-frequency-channel receiver, and the "T" array with its new tracking facility. Suitable procedures developed for observation, data acquisition, data processing, detection and calibration are discussed in detail. A dedicated data acquisition system was built for this purpose and suitable Fortran algorithms were developed for the data processing. Following these developments, observations were made on 20 candidates. The data thus obtained were folded over two-period stretches and were tested for significant detection of two pulses separated exactly by one period. With this criterion, 8 pulsars were detected successfully. Average pulse profiles, estimates for the average pulse energy etc, are presented for the 8 pulsars. Possiblities to study fluctuation spectra and low frequency variability of pulsar signals are considered and a few relevant observations are presented.

In the. last part of the thesis, a scheme devised to enable high time-resolution observations of highly dispersed pulsar signals is described! This scheme involves a basic swept-frequency dedispersion procedure similar to that used by Sutton et al.(1970). It can be shown, that due to the dispersion in the intervening medium, the pulsar signal at any instant in time gets mapped into the frequency domain. Therefore, a pulse profile over one full period (P) could be equivalently obtained, if the intensity as a function of frequency can be measured over a finite bandwidth (say Δf). This intensity pattern over the bandwidth Δf, which sweeps across the band with an approximate rate of $(-\Delta f/P)$, can be made to appear stationary in the frequency domain by appropriately sweeping also the centre frequency of the receiver. With this basic idea, a reliable programmable sweeping local oscillator system was built. The design of the system is described in detail. This system was used with the existing 128-channel autocorrelation receiver to obtain intensity pattern with high resolution in the frequency domain. The tracking facility was also used to enable higher time integration. A new method was used to avoid the need for gain calibration of individual frequency channels, and the need for absolute synchronisation of the sweep. It is shown, that with this method, higher resolution can be obtained for strong pulsar signals. The observational procedures along with the software algorithms developed for this purpose are presented. Use of this scheme has successfully demonstrated its ability to observe pulsars with dispersion measures as high as 35 $cm^{-3}pc$, with high sensitivity and high time-resolution. The results obtained using the two schemes are discussed in the later part of the thesis.