SPECTRA OF MILLISECOND (and other) PULSARS

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SPECTRA OF PULSARS

Warning

- Polarization
- Interstellar scintillations
- Long-term fading
- Calibration !!

Observation of a Rapidly Pulsating Radio Source

by

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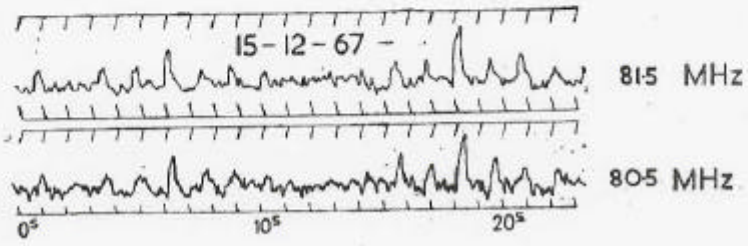
Unusual signals from pulsating radio sources have been recorded at the Mullard Radio Astronomy Observatory. The radiation seems to come from local objects within the galaxy, and may be associated with oscillations of white dwarf or neutron stars.

Nature, Vol. 217, No. 5130, pp. 709-713, February 24, 1968



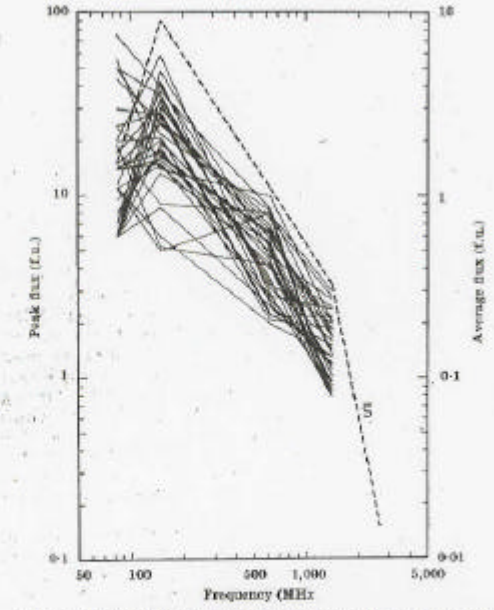


Fig. 4. Spectra of individual pulses between 85 and 1,419 MHz (peak flux scale refers to the continuous lines). The dashed line shows the average pulse height on March 25 integrated over 20 min near 20ʰ sidereal time (average flux scale). The 2,700 MHz measurement was made on March 28.

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Received May 7, 1968.

(*Reprinted from Nature, Vol. 218, No. 5147, pp. 1143-1145, June 22, 1968*)

First Effelsberg Paper !!

Nature Physical Science, Vol. 240, No. 102,
pp. 131-132, December 11, 1972

R. Wielebinski, W. Sieber, D.A. Graham,
H. Hesse, R.E. Schönhardt

Detection of Six Pulsars at 2.8 cm 10.6 GHz

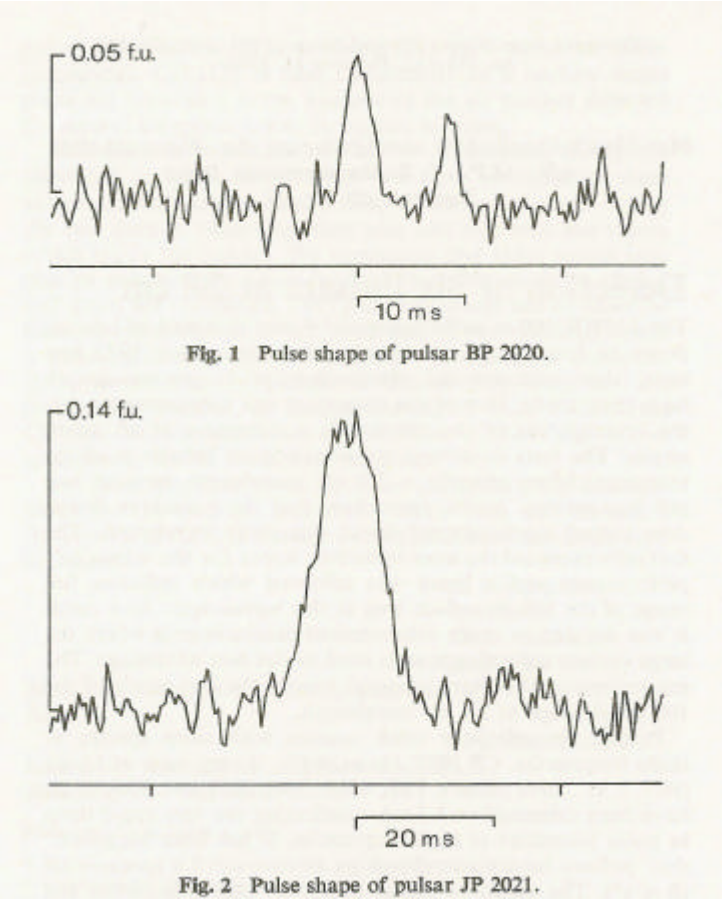


Fig. 1 Pulse shape of pulsar BP 2020.

Fig. 2 Pulse shape of pulsar JP 2021.

D.R. Stinebring et al. (2000, ApJ 539, 300-316)

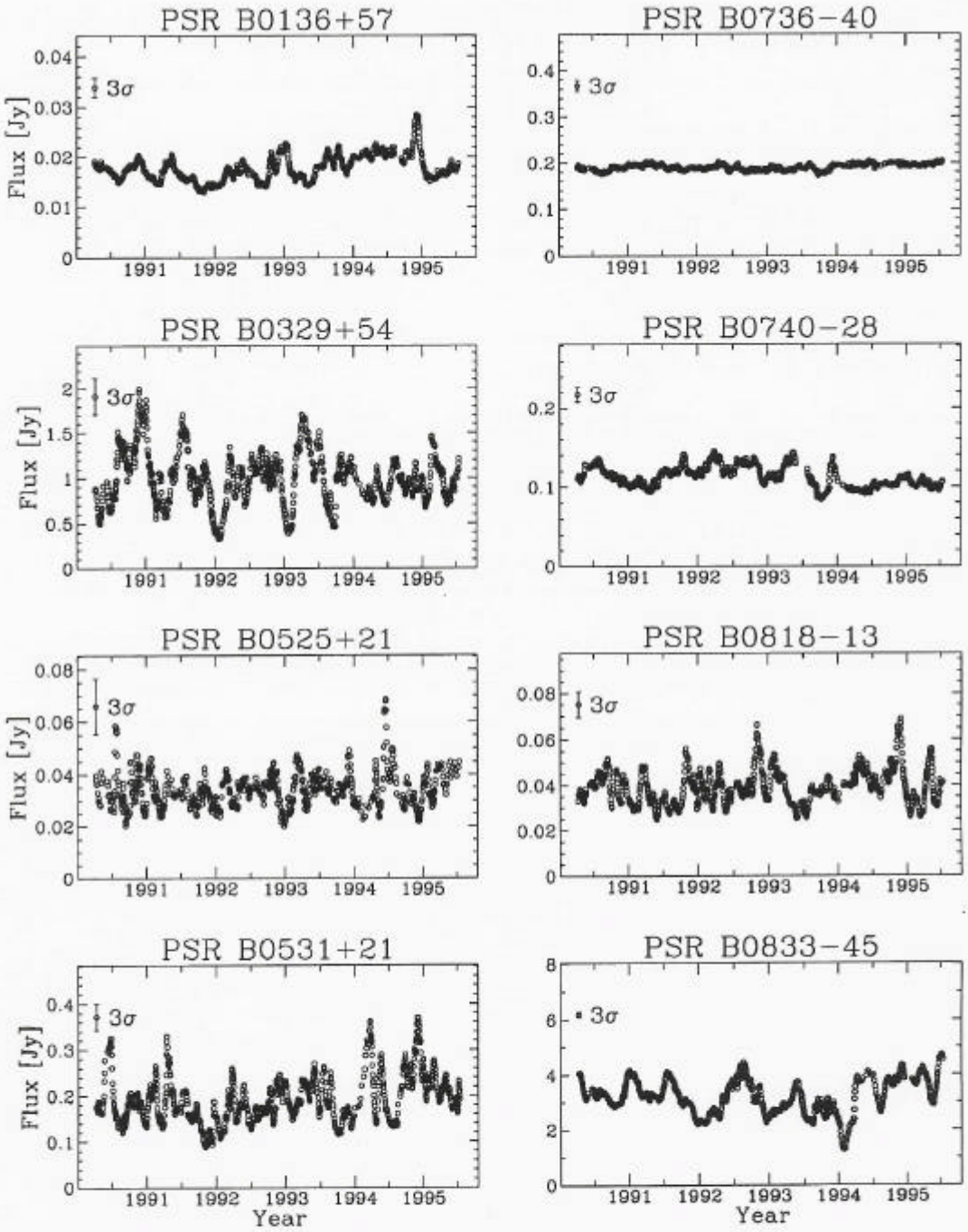


FIG. 3.—Flux density time series for 21 pulsars at 610 MHz. The ≈1000 points per time series are plotted as open circles. The time series has been smoothed by a five-point boxcar function. A 3 σ uncertainty, calculated from the spread of individual flux density values on a given day, is plotted for each pulsar. The day-to-day agreement between independent points is excellent, as can be seen particularly well for the time series that vary on long timescales. There are several pulsars (B0736−40, B1641−45, 1859+03, and 1946+35) that show little flux density variation over the 5 yr data span. Since no trends or common mode signals have been removed from any of these data, the time series attest to (1) the stability of our calibration procedure and (2) the radio luminosity stability of these pulsars over 5 yr. The pulsars with stable time series have large dispersion measures (and large scattering measures) indicating that the flux density variations seen for the more nearby pulsars are due to a propagation effect—refractive scintillation—not to intrinsic variability. Those time series that show significant variability have, for the most part, reached saturation; i.e., they have stationary statistics that would be unlikely to change over another 5 yr interval. Several of the pulsars (e.g., B0835−41, B1911−04, and B2111+46), however, show variability on longer timescales than is encompassed here. The maximum level of variability is not large. The most highly variable time series, such as those for pulsars B0329+54 and B1642−03, have modulation indexes less than 0.5.

V.M. Malofeev et al.

(2000, Astronomy Reports 44, No. 7, 436-445)

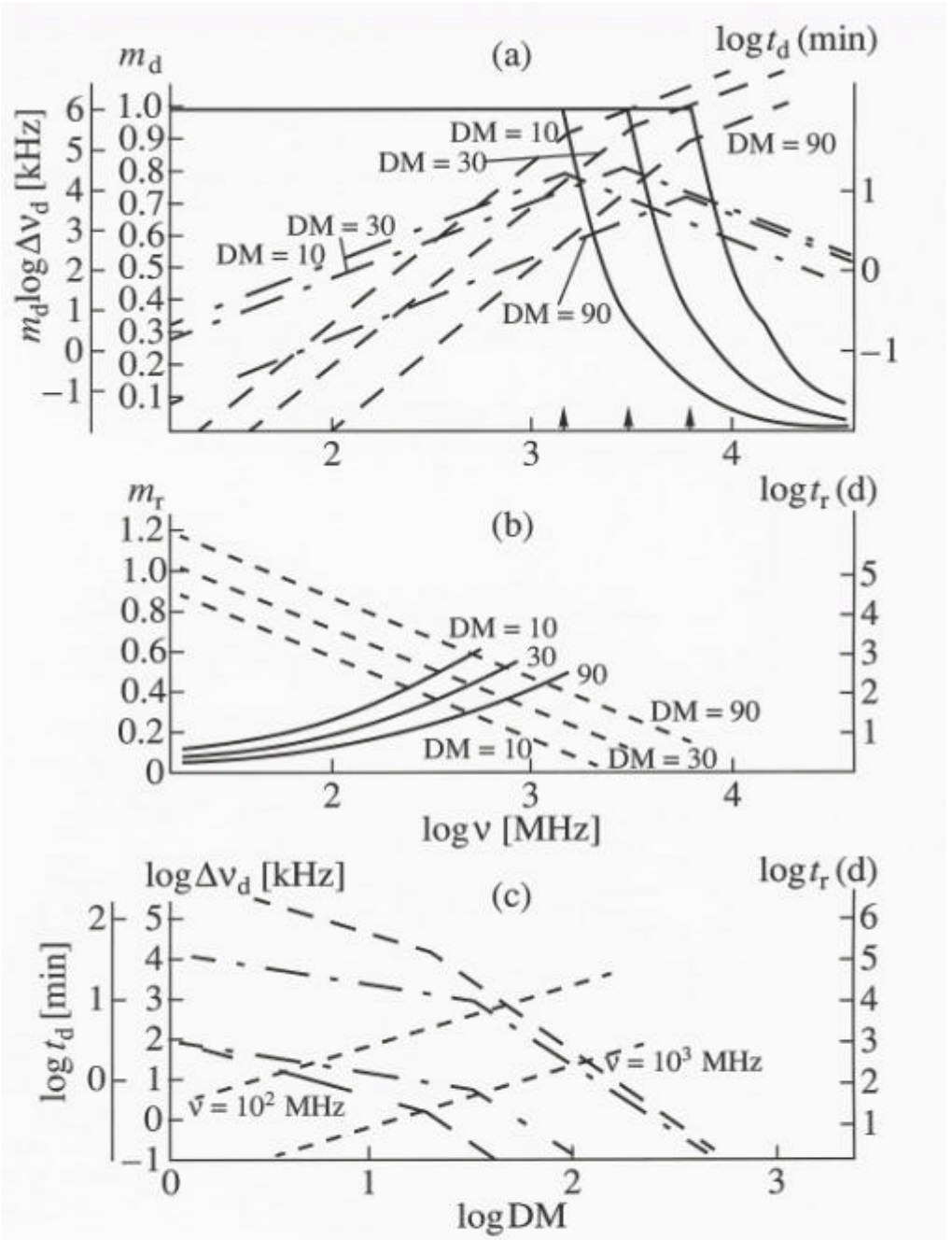
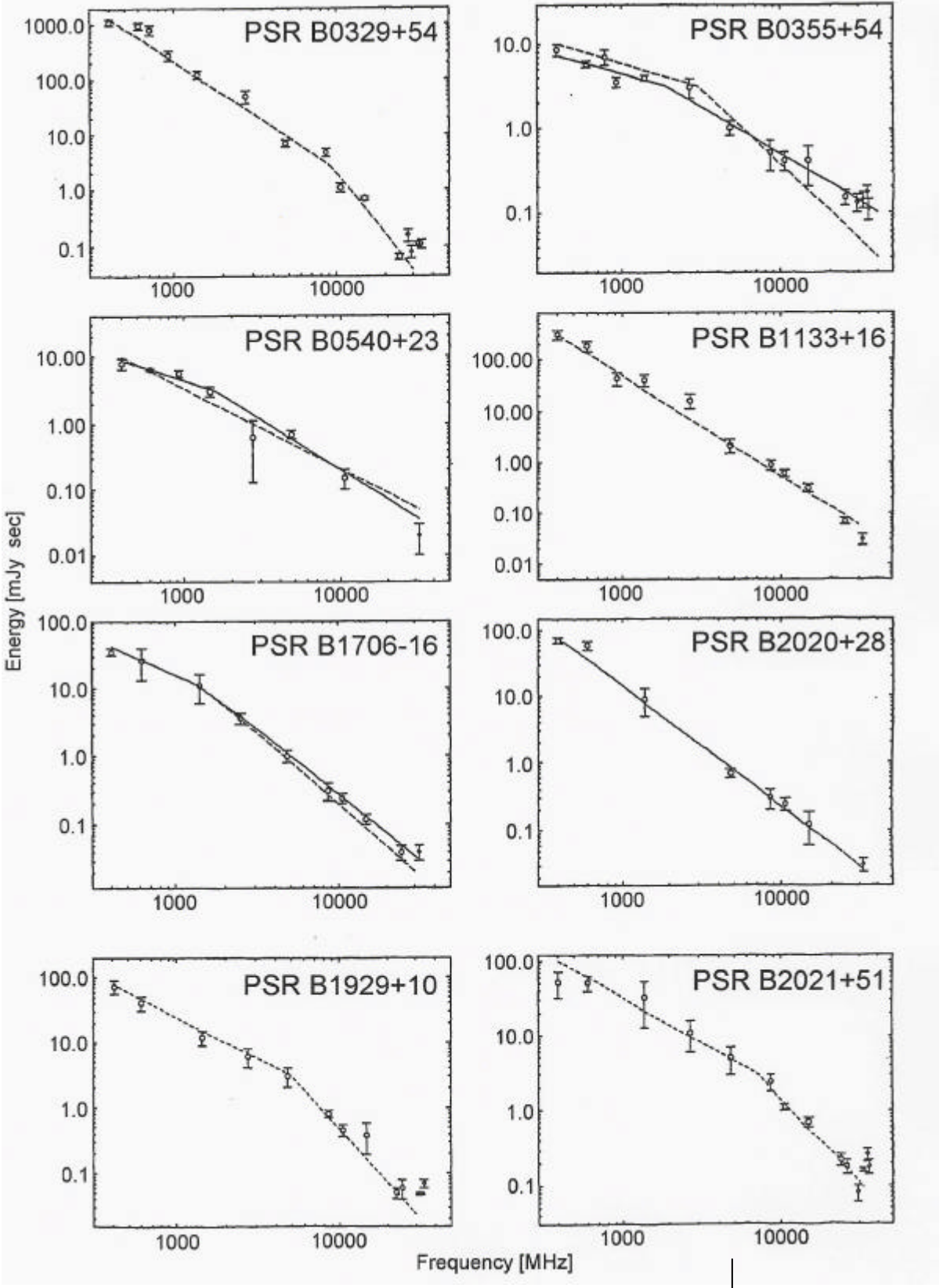
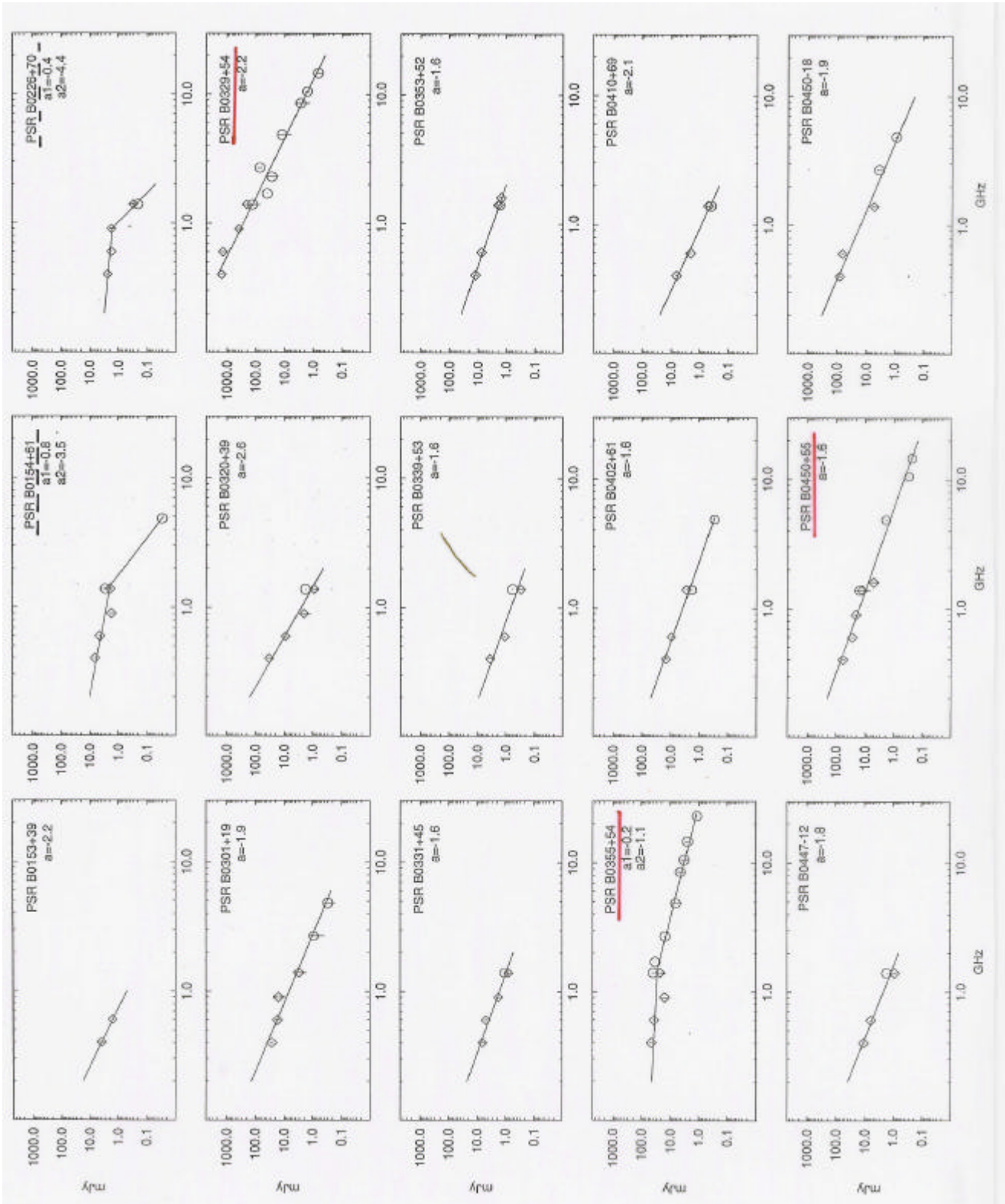


Fig. 2. Empirical dependences of the parameters of (a) diffractive scintillations and (b) refractive scintillations on frequency and (c) on dispersion measure. The solid line corresponds to m, the long dashed curve to $\Delta\nu_d$, the dot-dash curve to t_d, and the short dashed curve to t_r.

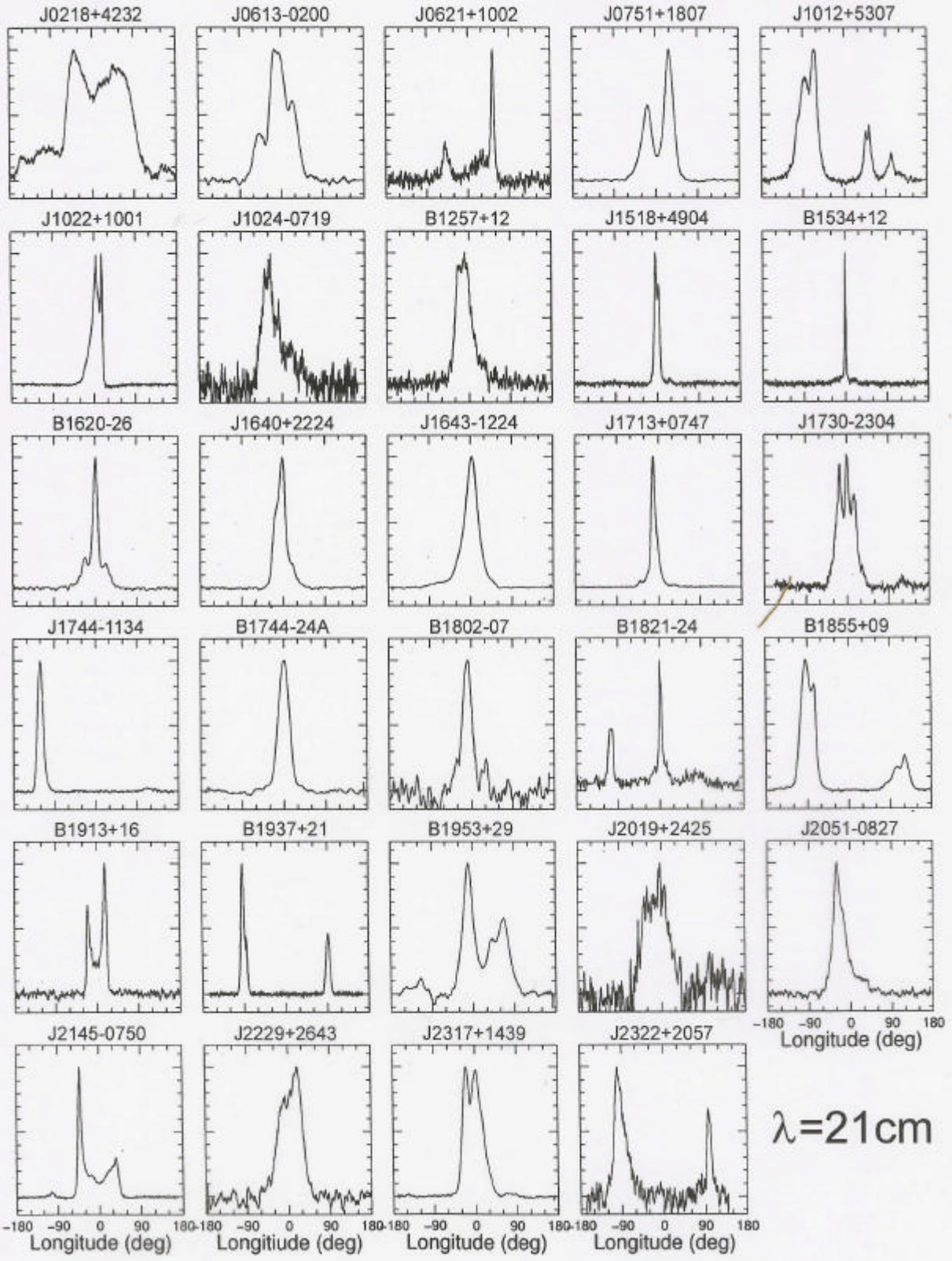


Pushchino, Jodrell Bank, Arecibo, Parkes Effelsberg

Maron, Kijak, Kramer, Wielebinski (1999)



Effelsberg Millisecond Pulsar Profiles



Astron. Astrophys. 318, L63–L66 (1997)

Letter to the Editor

Observations of millisecond pulsars at 4.85 GHz

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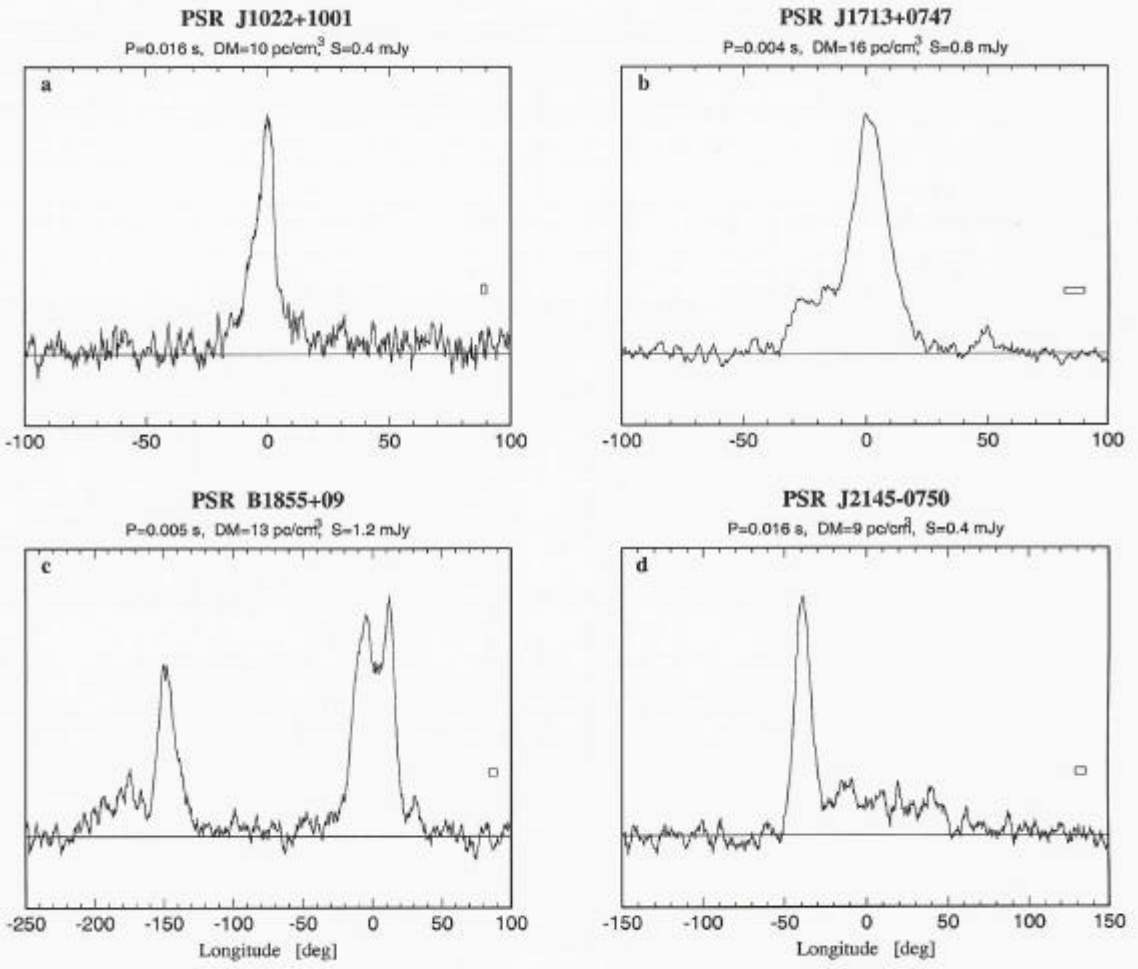
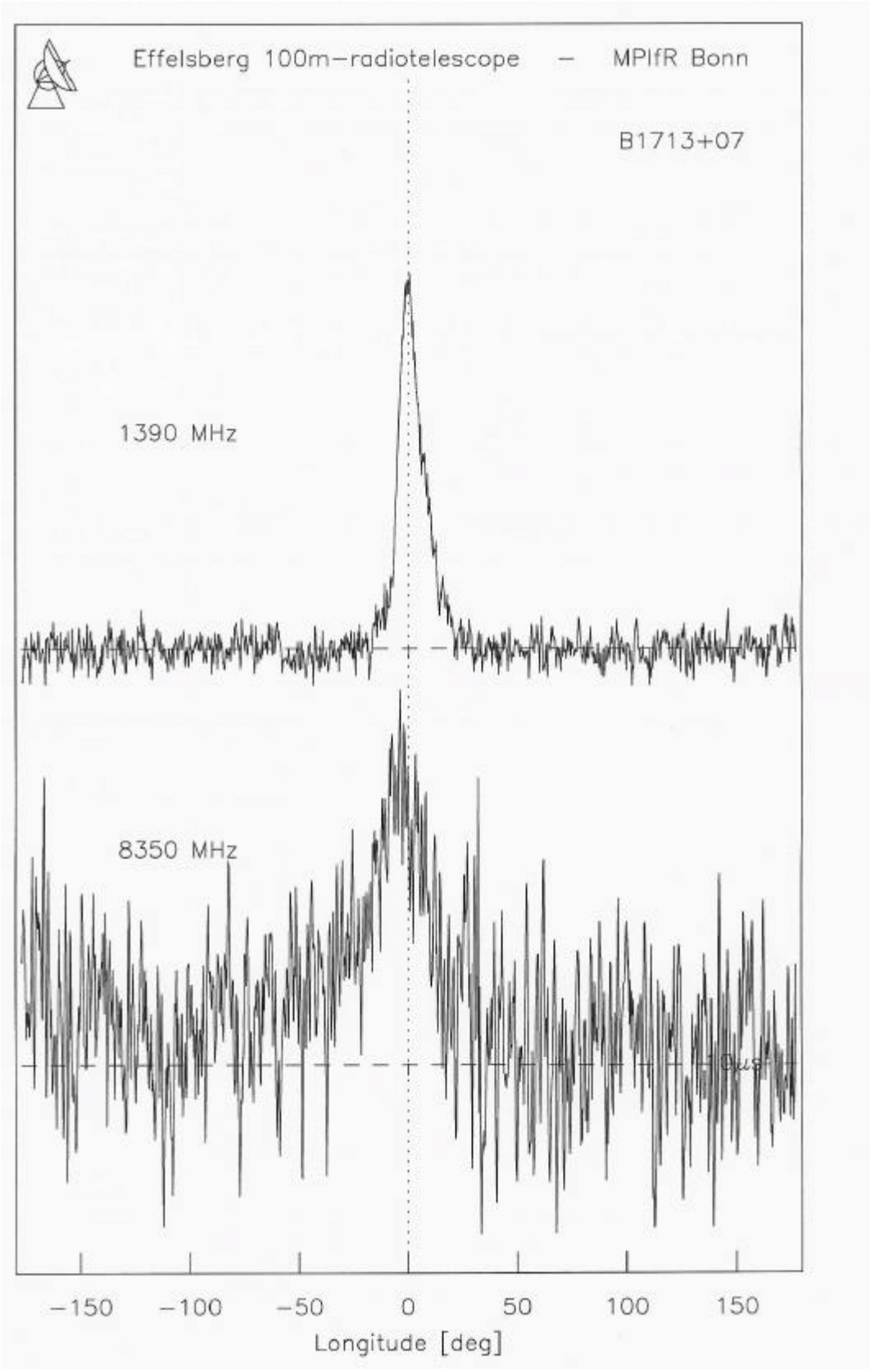


Fig. 1. Total intensity profiles observed at 4.85 GHz of a) PSR J1022+1001, b) J1713+0747, c) PSR B1855+09 and d) PSR J2145−0750.

O. Maron et al.


Effelsberg 100m–radiotelescope – MPIfR Bonn
B1713+07
1390 MHz
8350 MHz
–150
–100
–50
0
50
100
150
Longitude [deg]

M. Kramer et al. (1999, ApJ 526, 957-975)

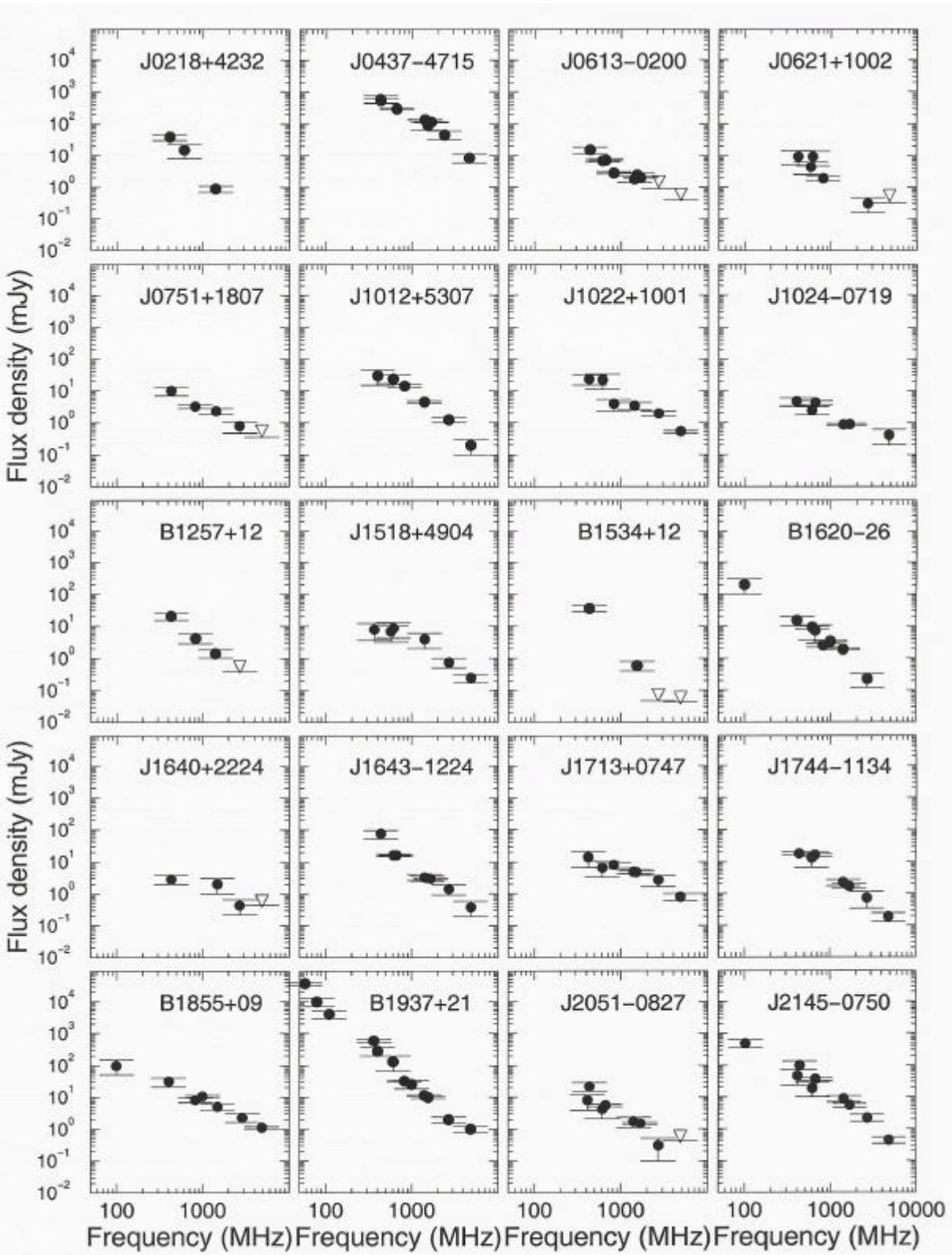


FIG. 1.—Flux density spectra for 20 millisecond pulsars discussed in this work. See text for references.

THE ASTROPHYSICAL JOURNAL, 506:863–867, 1998 October 20

SPECTRA OF SOUTHERN PULSARS

M. TOSCANO,[1,2] M. BAILES,[2] R. N. MANCHESTER,[3] AND J. S. SANDHU[4]

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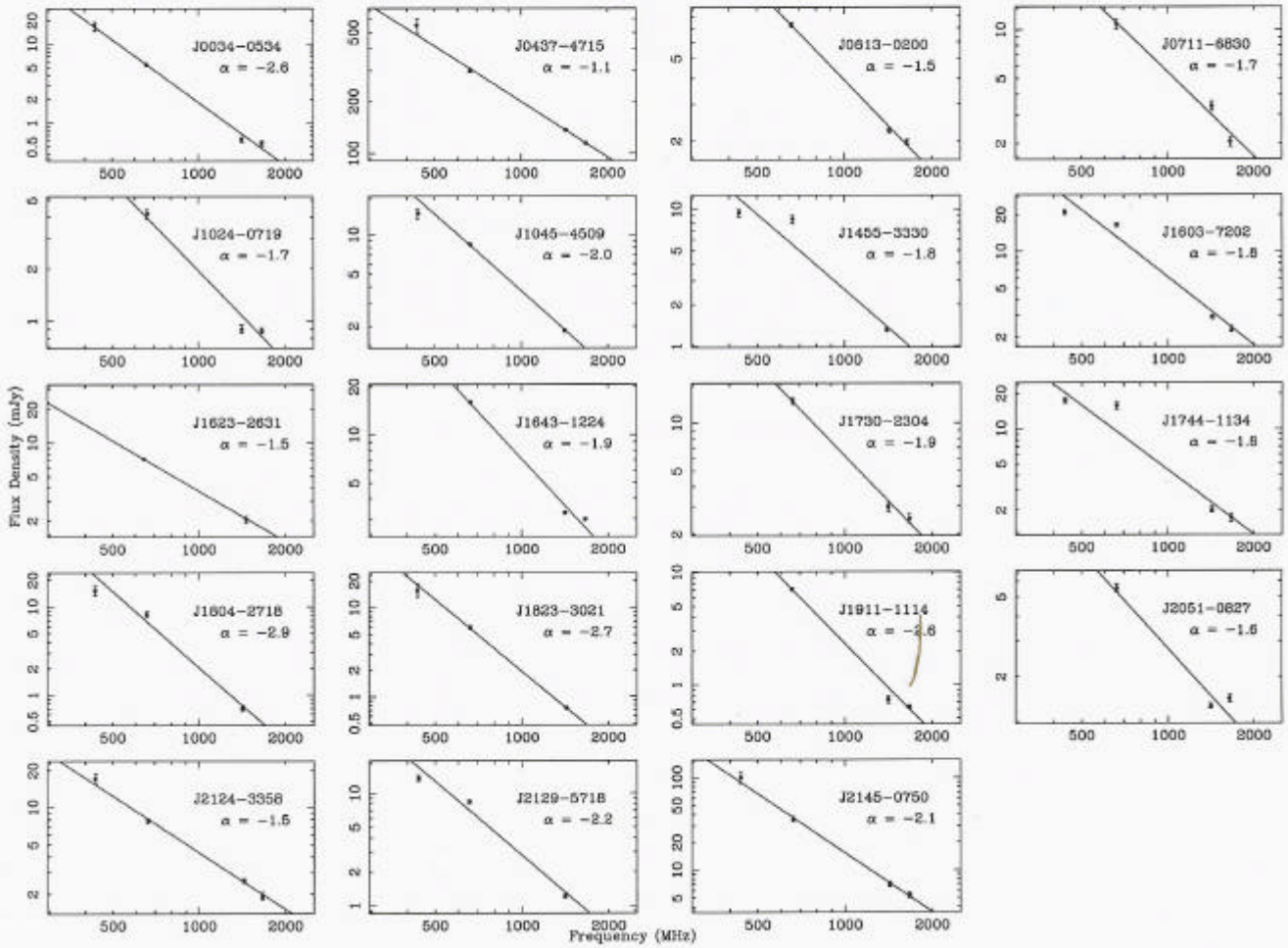
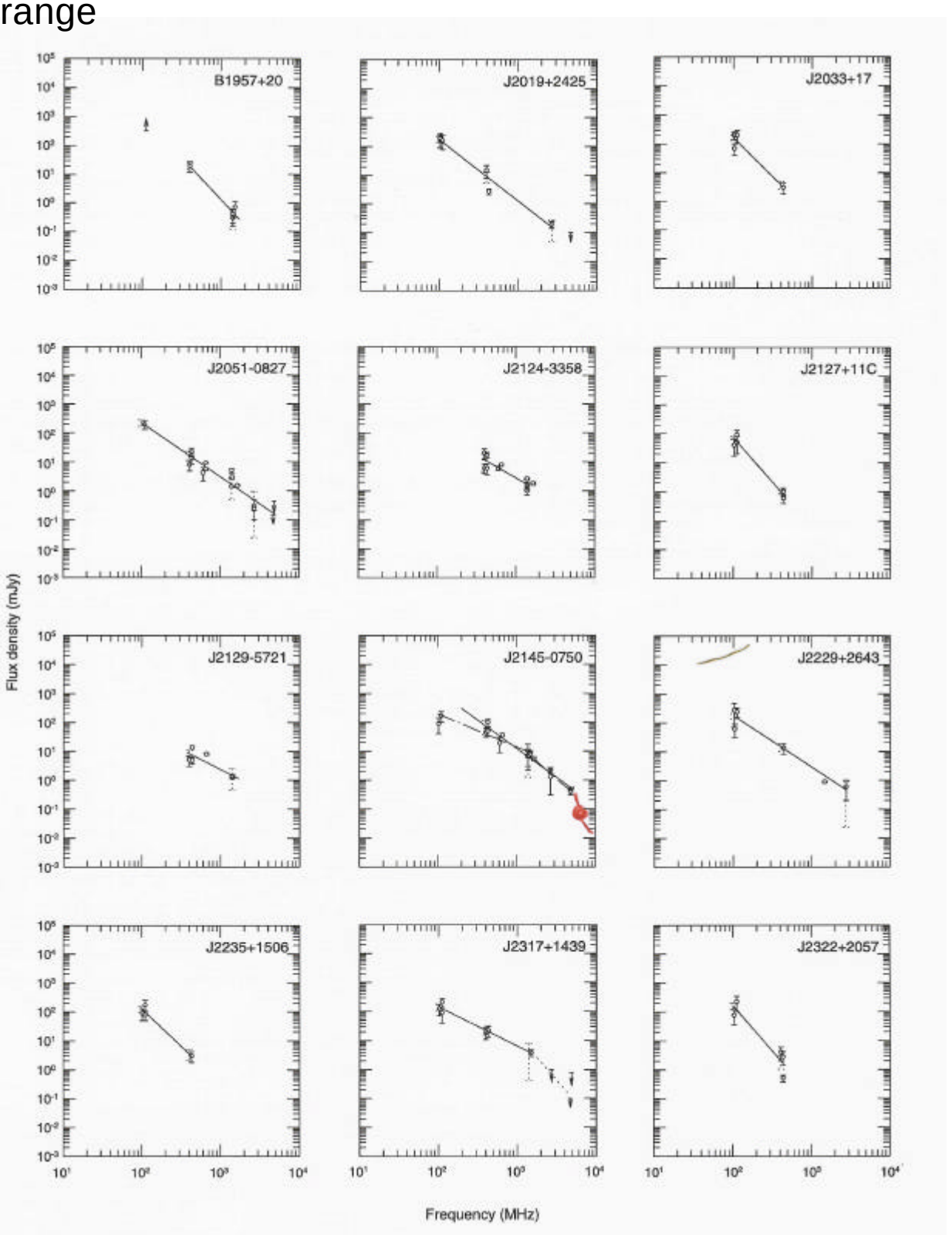


FIG. 1.— Spectra for 19 MSPs, illustrating that MSP spectra between 400 and 1700 MHz are often well described by a power law

V.M. Malofeev et al. (2003, A&A, in preparation)
Spectra of 48 millisecond pulsars in a wide frequency range



Summary

- Spectra of millisecond pulsars are similar to that of normal (slow) pulsars
- This suggests similar emission mechanism
- Recent observations show high-frequency and low-frequency spectral breaks
- Polarization of millisecond pulsars and normal pulsars show similar behaviour
- The luminosity of millisecond pulsars is one order of magnitude lower than that of normal pulsars