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The study of the variability of interstellar scattering in pulsar observations conducted with the PL611 LOFAR station.

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The received radiation from pulsars, gets affected by the interstellar medium (ISM) as it propagates through its turbulent and ionised plasma. One of the ways the ISM distorts the received signal is scattering. Because of it the profiles become asymmetrically wider, especially in low radio frequencies where scattering is more dominant. Thanks to low frequency (30-240 MHz) radio telescopes such as LOFAR (LOw Frequency ARray), LWA (Long Wavelength Array) and MWA (Murchison Widefield Array) it is possible to gather large volumes of good quality low radio frequency data and study these ISM effects in detail.

For the last 5 years we have been observing a small sample of nearby and bright pulsars whose profiles are affected by scattering. For this work, we have been using the POLFAR station (PL611) close to Łazy, Krakow, in single station ´HBA mode.

From the multi-frequency recorded profiles we estimate the pulse broadening caused by pulsar scattering (τ) and its frequency scaling factor (α), using both an isotropic and anisotrpopic model of the ISM internal turbulence distribution. The estimation of the α value is very important in deriving information about the turbulent properties of the ISM, because it describes the frequency dependence of the scattering process, which can be used to infer information about the medium itself.

We find that our α value estimations differ from the expected values expected from either a Kolmogorov or Gaussian turbulence spectrum. Over the course of the last five years, we have been monitoring a specific set of pulsars on a monthly basis. As a result, we have accumulated as many as 50 separate estimates of τ and α for each observer target. This has provided us with the opportunity to examine how these parameters vary over time, using Deep Learning techniques which also help us in outlier detection and pattern/trend detection.

We also monitor the Dispersion Measure (DM) variability for an even larger sample of pulsars, which includes objects not affected by scattering in any significant way. This study can help us determine how the turbulence is distributed across different scales and identify the characteristic length scales of the turbulence. In summary, in this work, we show that long term pulsar monitoring with just a single LOFAR station is capable of producing a

large volume of good quality data with a focus on the ISM tubulence, anisitropy and inhomogeneity through the study of the variations of interstellar scattering.