Contribution ID: **40** Type: **not specified**

The glitch activity of the Crab pulsar

Wednesday, 26 March 2014 15:35 (20 minutes)

The rotation of the Crab pulsar has been regularly monitored at Jodrell Bank Observatory and other observatories for 44 years. Like most pulsars, its regular spindown is occasionally interrupted by sudden spin-up events known as glitches. Glitches are thought to be the response of a dense internal neutron superfluid to the pulsar's spindown. Here we report on a detailed study of the rotation stability of the Crab pulsar. We identify all the glitches and find that their sizes are well above the detectability limits, allowing us to uncover the full size distribution. The distribution falls off as glitch size decreases and indicates the existence of a minimum size, thereby challenging the predictions of most glitch models. In addition to the glitches, we also identify a low-amplitud separate population of irregularities that present clear noise properties. Glitches can greatly affect the long-term spin evolution of pulsars and for the Crab pulsar the main disturbance is the one caused by persistent step-changes in spindown rate occurring at every glitch. We find that these steps reverse the general spindown trend by ˜5% and that their amplitudes are correlated with the size of the glitches. In addition, the time series of the glitches exhibits a 10-year period of increased activity which introduces further, unexpected effects on the rotational behaviour.

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Session Classification: Afternoon session - Parallel A