



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 2393

Type: Oral (Non-Student) / Orale (non-étudiant(e))

An Analytic Study of the Fourier Transform of the Gravitational Wave Pulsar Signal with Spin-down Effects

Monday 3 June 2019 11:45 (15 minutes)

The direct detection of gravitational waves from pulsars is a much anticipated discovery in the emerging field of multi-messenger gravitational wave (GW) astronomy. In this context we develop an analytic approach to study the Fourier Transform (FT) of the GW pulsar signal including spindown effects. To incorporate the spindown effects, we incorporate an extended model of Alvarez and Carraminana (2004), which includes the quadrupole term that accounts for the emission of gravitational radiation and assumes an inverse linear law of magnetic field decay of the pulsar (Chishtie et al, 2018). With this approach we are able to extract an all-order formula for the spindown parameters using the Taylor series representation of Jaranowski et al.(1998). We then include these spindown corrections in the overall FT expression of the GW pulsar signal and then analyze these corrections for the cases of the Crab, PSR B1509-58, PSR B0540-69 and Vela pulsars.

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Session Classification: M1-4 Mathematical Physics (DTP) | Physique mathématique (DPT)

Track Classification: Theoretical Physics / Physique théorique (DTP-DPT)