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Probing increasingly younger neutron stars through continuous gravitational waves with higher-order spin-down parameters.

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Wide-band searches for continuous gravitational waves are essential to reveal unknown neutron stars without an electromagnetic counterpart. Such searches, however, cover a huge parameter space that makes them computationally bounded. Neutron stars are predicted to slow down their rotation by losing energy through a variety of physical mechanisms, including, e.g. electromagnetic and gravitational-wave emission. The simplest possible model describes neutron stars slowing down at a constant rate by a first-order spin-down parameter that, for one-year long observing runs, is expected by neutron stars thousands or more years old. In this talk I will show that, to exploit the improved sensitivity of Einstein Telescope at low frequencies and the many-years long runs, there is the need to enlarge the parameter space to higher-order spin-down terms. I will show that in this way we can broaden the search to younger neutron stars, up to hundreds of years old or less, and discuss a possible implementation of a search including this extended model.

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