## Abstract Submitted for the APR16 Meeting of The American Physical Society

Gravitational-wave cosmology across 29 decades in frequency CHIARA MINGARELLI<sup>1</sup>, Caltech, PAUL LASKY<sup>2</sup>, Monash University, TRISTAN SMITH, Swarthmore College, JOHN T. GIBLIN, Kenyon College, ERIC THRANE, DANIEL REARDON, Monash University, ROBERT CALDWELL, Dartmouth College, PARKES PULSAR TIMING ARRAY COLLABORATION — We derive constraints on the spectrum of the primordial gravitational wave background, and hence on theories of the early Universe, by combining experiments that cover 29 orders of magnitude in frequency. These include Planck observations of cosmic microwave background (CMB) temperature and polarization power spectra and lensing, together with baryon acoustic oscillations and big bang nucleosynthesis measurements, and new pulsar timing array and ground-based interferometer limits. The combination of experiments allows us to constrain cosmological parameters, including the inflationary spectral index,  $n_t$ , and the tensor-to-scalar ratio, r. Results from individual experiments include a stringent nanohertz limit of the primordial background from the Parkes Pulsar Timing Array,  $\Omega_{\rm f}(f) < 2.3 \times 10^{-10}$ . Observations of the CMB alone limit the gravitational-wave spectral index at 95% confidence to  $n_t$ 5 for a tensor-to-scalar ratio of r = 0.11. However, the combination of all the above experiments limits  $n_t < 0.36$ . Future Advanced LIGO observations are expected to further constrain  $n_t < 0.34$  by 2020. When CMB experiments detect a non-zero r, our results will imply even more stringent constraints on  $n_t$  and hence theories of the early Universe.

Chiara Mingarelli Caltech

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<sup>&</sup>lt;sup>1</sup>Mingarelli is the 2nd author on the submitted manuscript.

<sup>&</sup>lt;sup>2</sup>Lasky is the 1st author of the manuscript submitted to PRX, but cannot attend the meeting.