Common-spectrum process in the search for nanohertz gravitational-wave background with the PPTA and the EPTA

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EPTA

PPTA

Results with the Parkes Pulsar Timing Array

GONCHAROV, THRANE, SHANNON, HARMS ET AL. "CONSISTENCY OF THE PPTA SIGNAL WITH A NANOHERTZ GRAVITATIONAL WAVE BACKGROUND." THE ASTROPHYSICAL JOURNAL LETTER, ACCEPTED.

ARXIV: 2206.03766

GONCHAROV, SHANNON, REARDON, HOBBS, ZIC, ET AL. "ON THE EVIDENCE FOR A COMMON-SPECTRUM PROCESS IN THE SEARCH FOR THE NANOHERTZ GRAVITATIONAL-WAVE BACKGROUND WITH THE PARKES PULSAR TIMING ARRAY." THE ASTROPHYSICAL JOURNAL LETTERS 917, NO. 2 (2021): L19.

ARXIV: 2107.12112

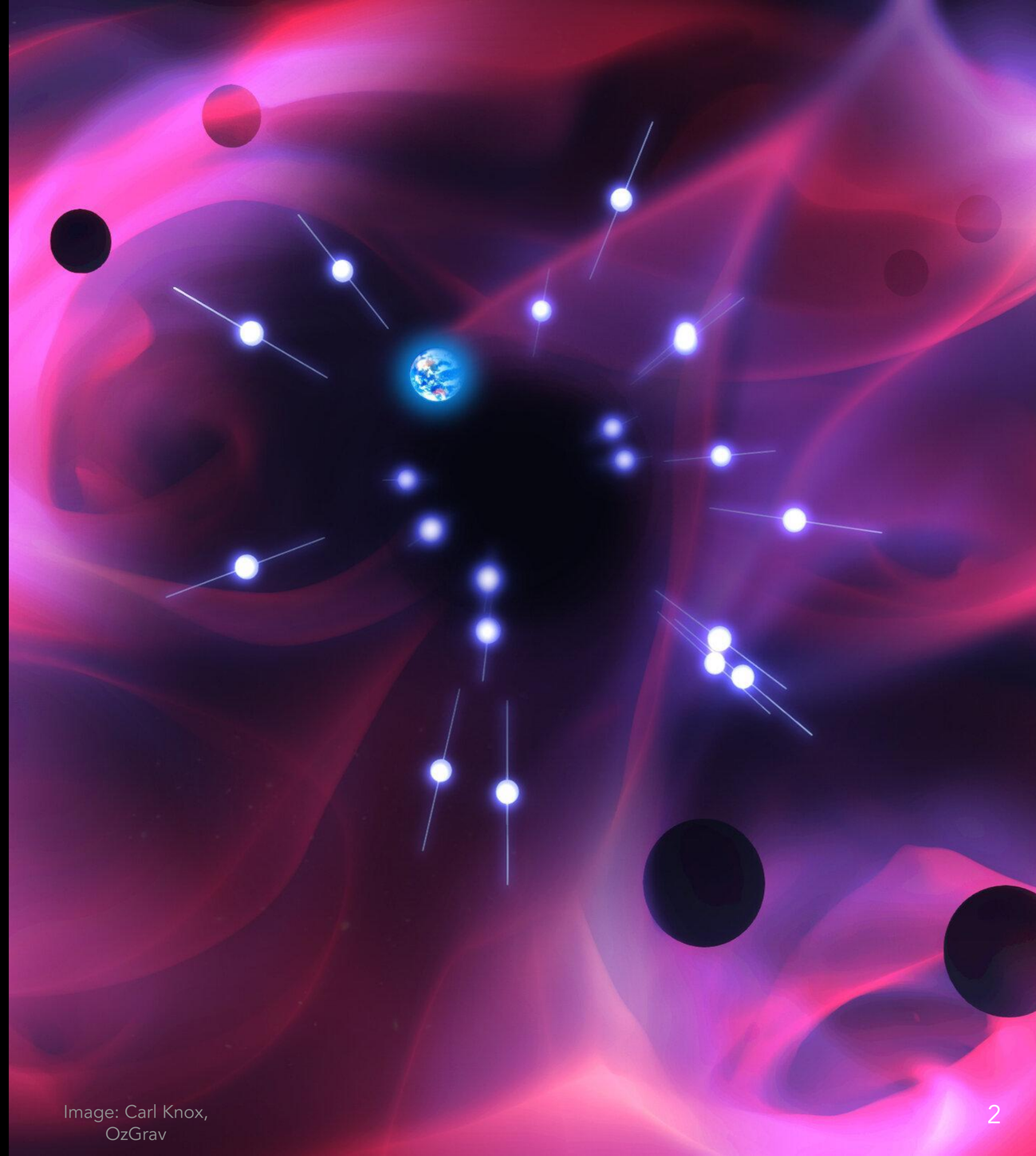
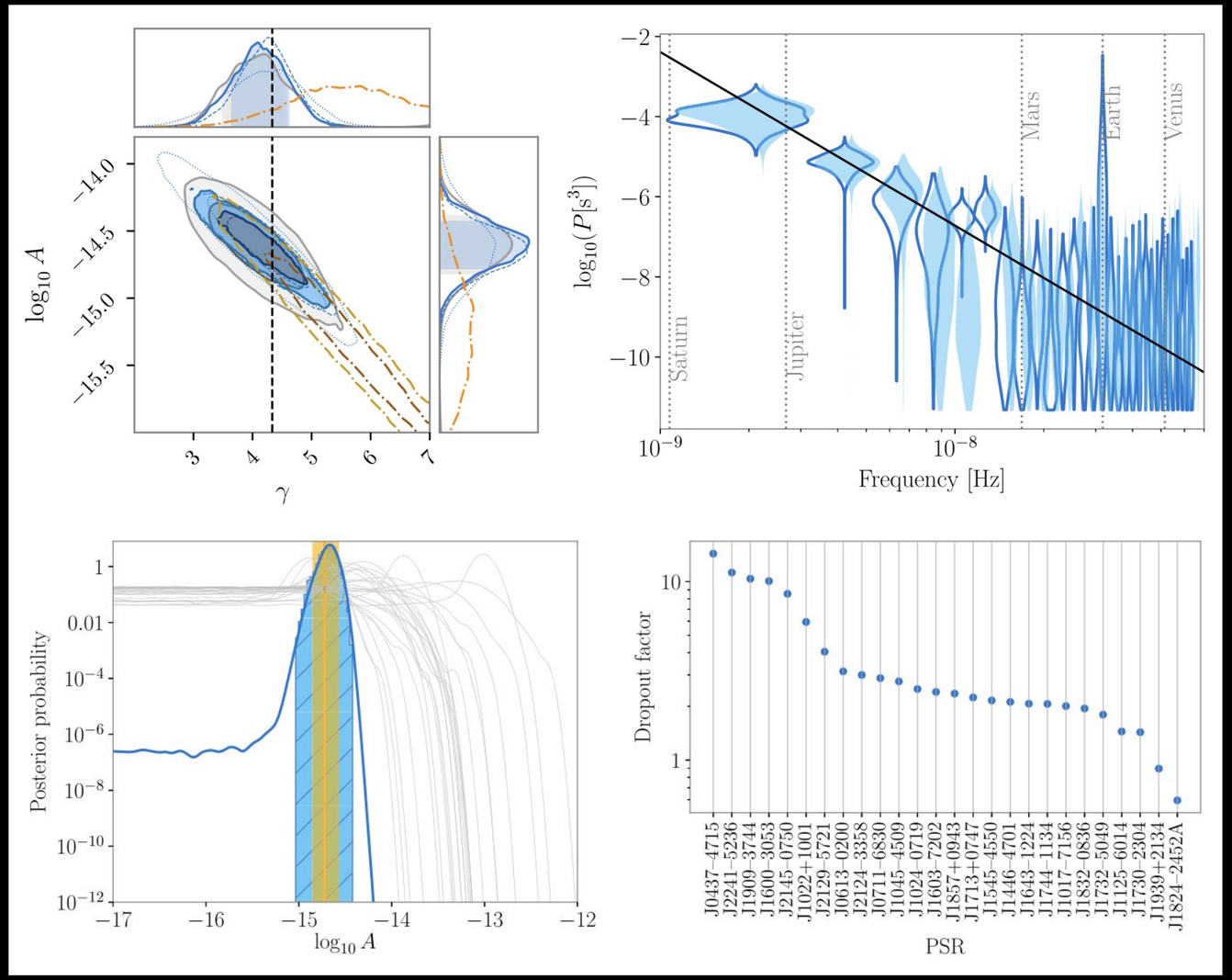


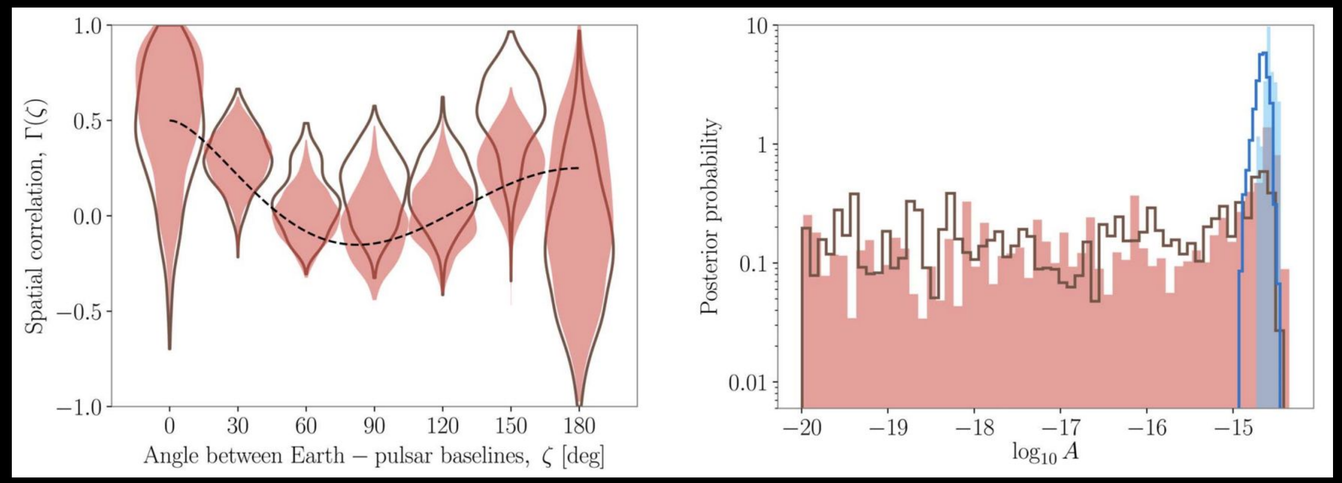
Image: Carl Knox, OzGrav

COMMON-SPECTRUM PROCESS



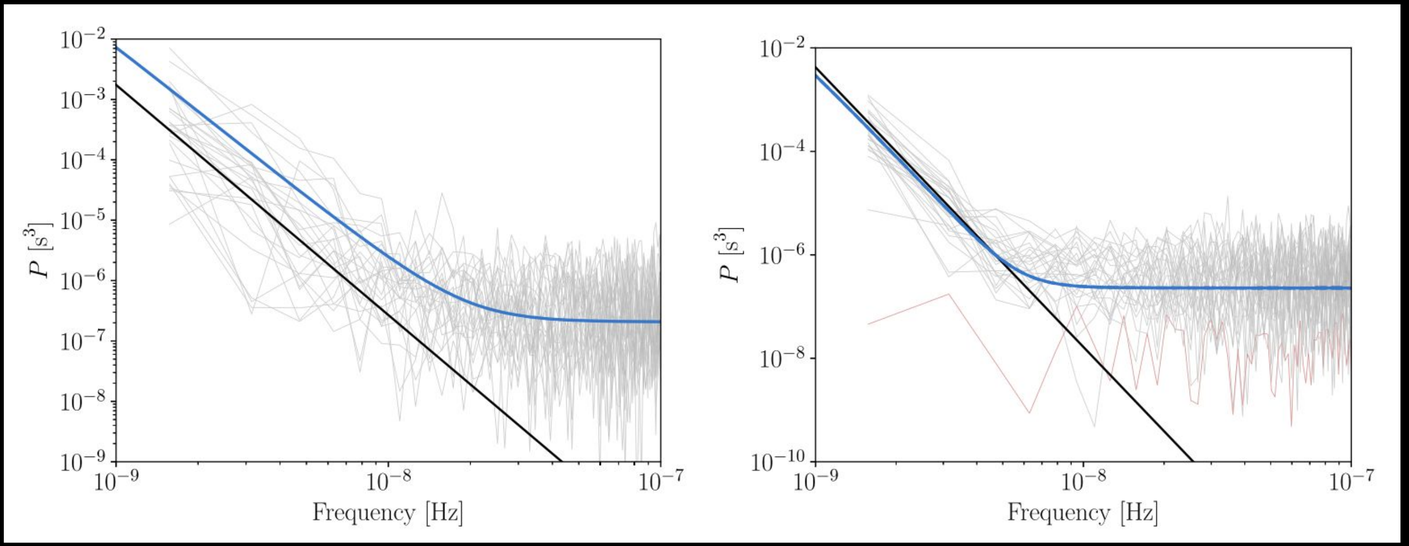
- Strong evidence for the common-spectrum process (with caveats)
- Strongly ruling out purely monopolar and dipolar correlations
- Ruling out errors in Solar System ephemerides as a source of the common red process

SEARCHING FOR THE SPATIAL CORRELATIONS INDICATIVE OF THE NANOHERTZ GW BACKGROUND



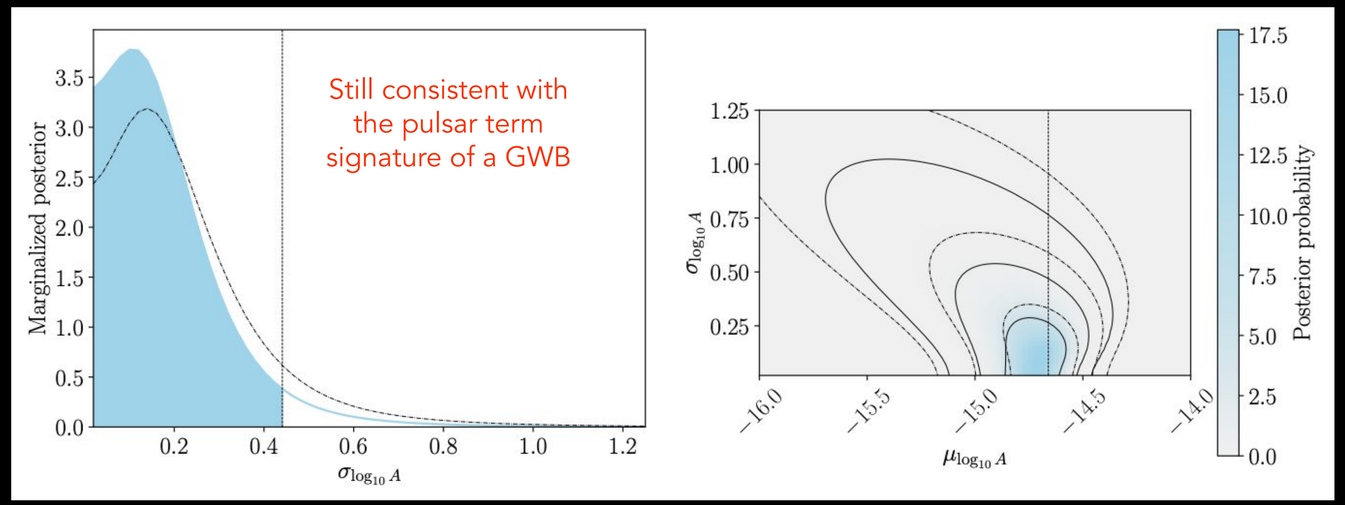
- Weak evidence for spatial correlations in the PPTA data, logBF = 0.3. (Without J0437-4715, logBF = 1.0)
- Strongly ruling out purely monopolar and dipolar correlations
- New exciting results are expected soon!

LIMITATIONS OF THE COMMON-SPECTRUM PROCESS MODEL

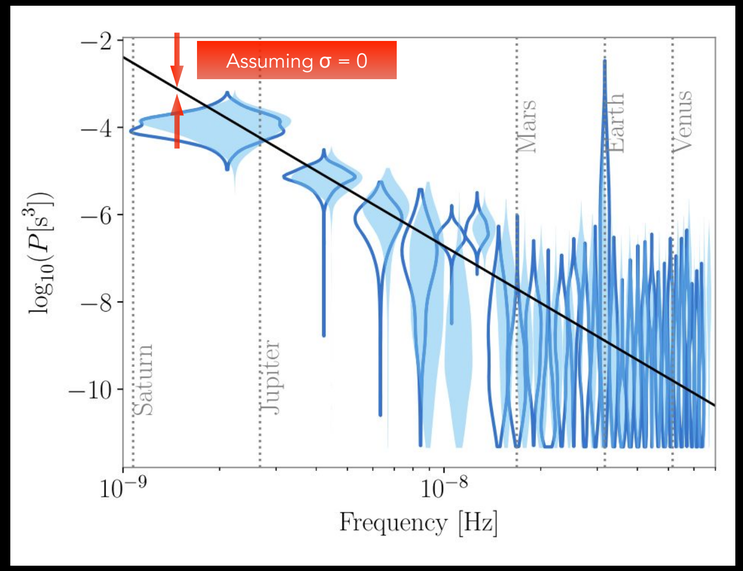


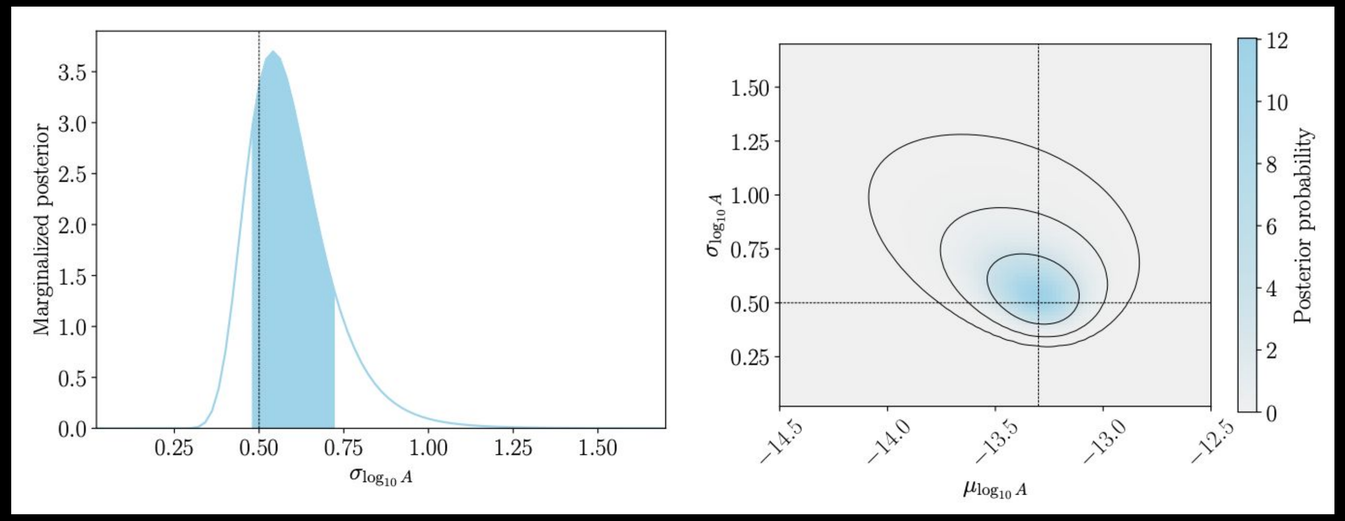
- Left: similar spectra
- Right: common spectra with an outlier
- Both show evidence for the common-spectrum process

COMMON VS. QUASI-COMMON



Data, PPTA DR2





Simulation validation

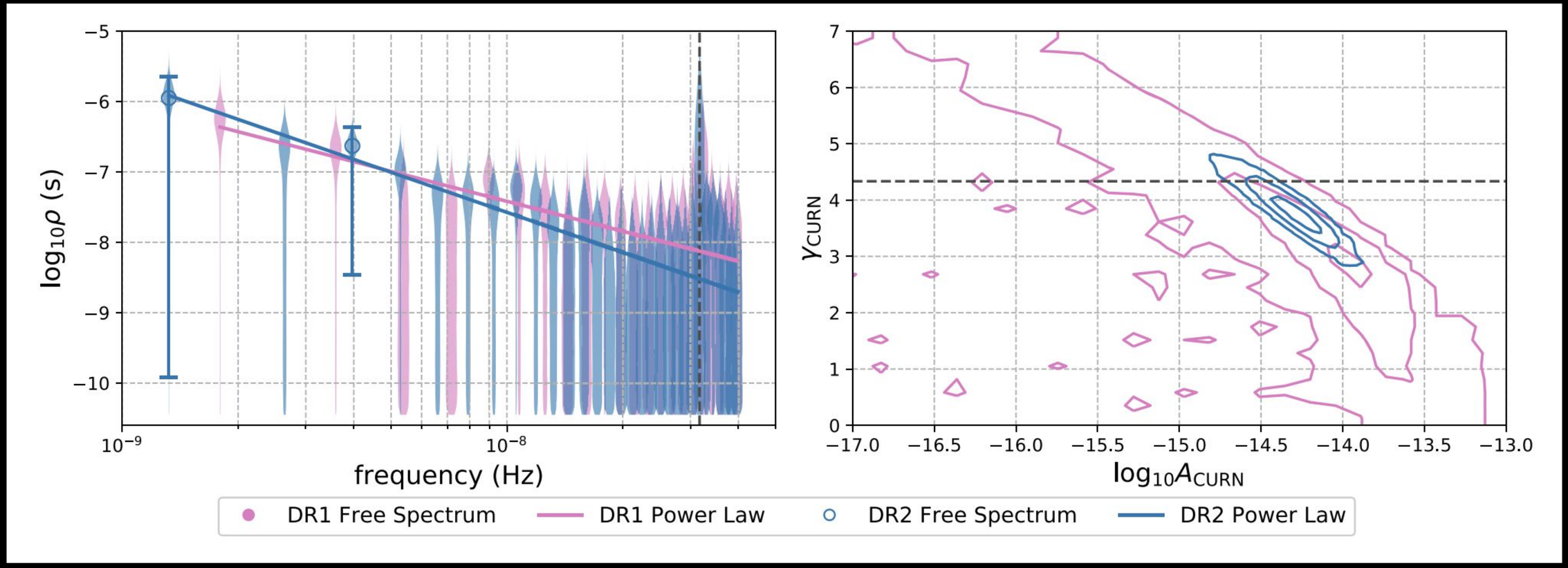
Results with the European Pulsar Timing Array

CHEN, CABALLERO, GUO, CHALUMEAU, LIU, SHAIFULLAH, LEE, BABAK, DESVIGNES, PARTHASARATHY, HU, VAN DER WATEREN, ANTONIADIS, BAK NIELSEN, ET AL. "COMMON-RED-SIGNAL ANALYSIS WITH 24-YR HIGH-PRECISION TIMING OF THE EUROPEAN PULSAR TIMING ARRAY: INFERENCES IN THE STOCHASTIC GRAVITATIONAL-WAVE BACKGROUND SEARCH." MNRAS 508.4 (2021): 4970-4993.

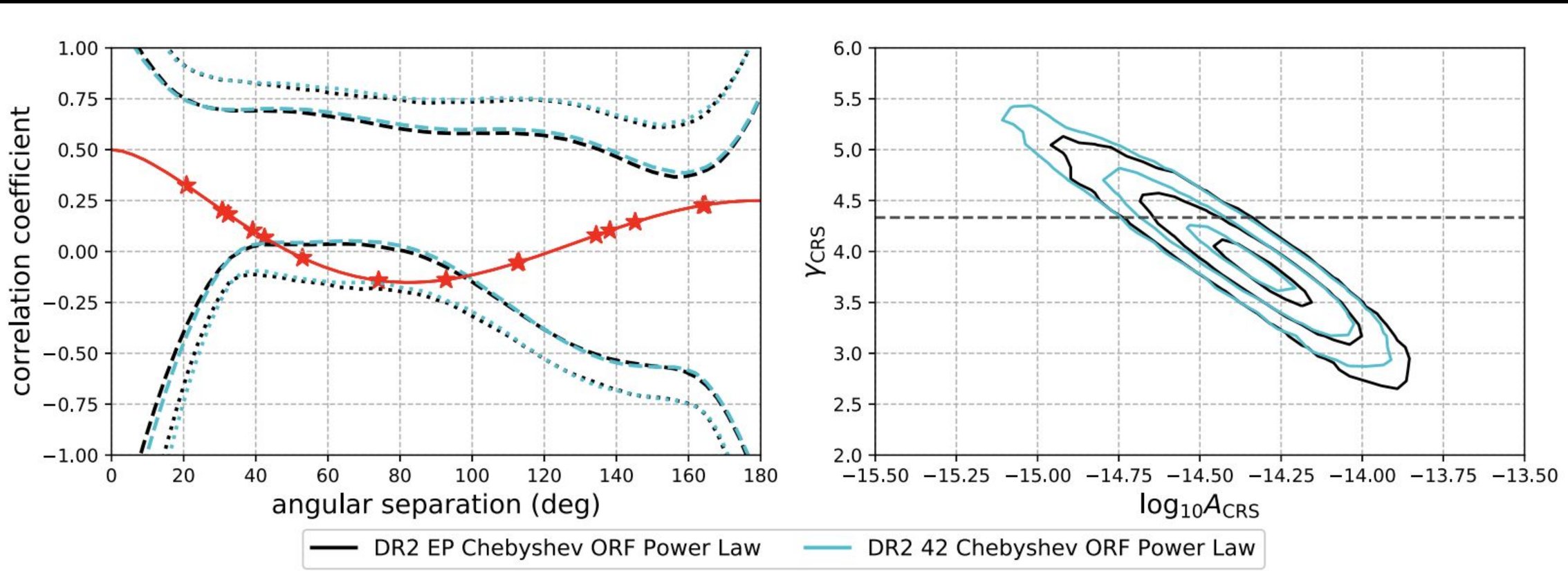
ARXIV: 2110.13184

Image: Olena Shmahalo, Quanta Magazine

COMMON-SPECTRUM PROCESS



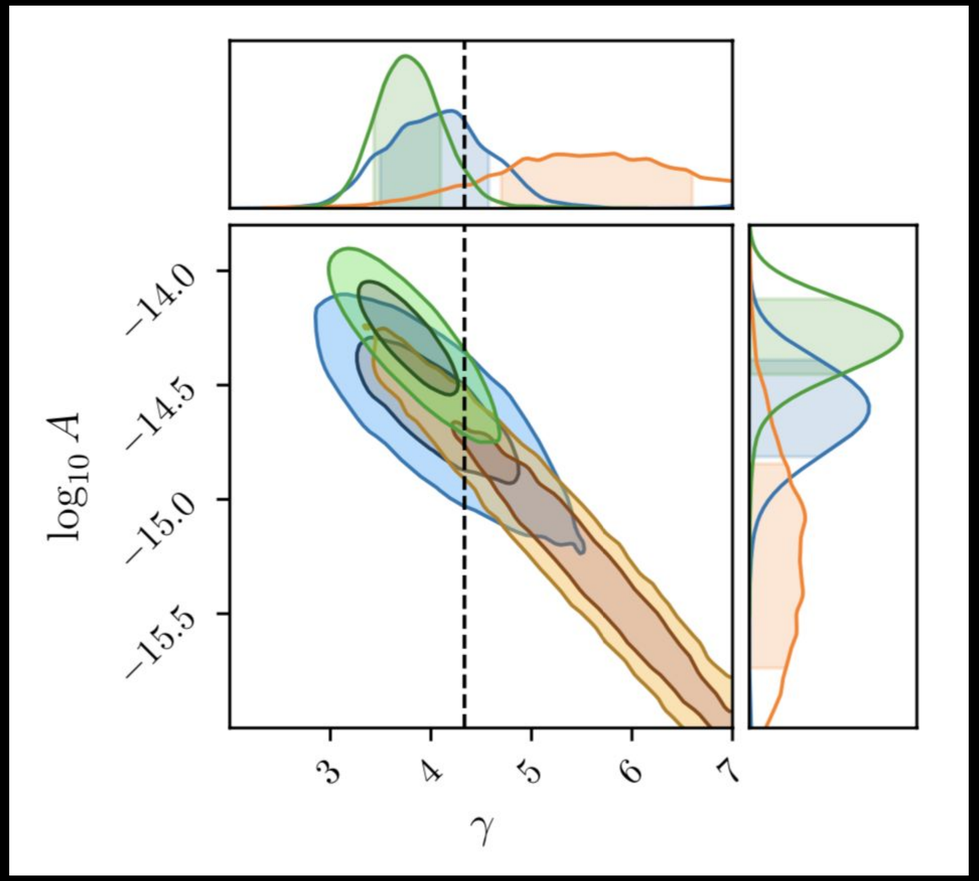
CONSTRAINTS ON SPATIAL CORRELATIONS



NANOGRAV + PPTA + EPTA

RENZINI, GONCHAROV, JENKINS, MEYERS "STOCHASTIC GRAVITATIONAL-WAVE BACKGROUNDS: CURRENT DETECTION EFFORTS AND FUTURE PROSPECTS." GALAXIES 10.1 (2022): 34..

ARXIV: 2202.00178



Thank you!

Interested in collaborations on applying your new models to Einstein Telescope and Pulsar Timing Arrays? Please get in touch:

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