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Origin of pulsar radio emission

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For more than five decades, the origin of pulsar radio emission have been one of the major unsolved problems in astrophysics. It is universally believed that generation of radio emission is intimately connected with pair plasma production initiated by high energy gamma-rays in pulsar polar caps. Here I will present the results of our study of electron-positron pairs creation near magnetic poles of neutron stars which provide a clue to this long-standing mystery. We directly demonstrate that the intermittency of the pair creation process and its naturally-arising non-uniformity across magnetic field lines lead to the emission of strong coherent electromagnetic waves with properties commensurate with that of the observed pulsar radio emission. These waves are only moderately damped by dense plasma and should escape the magnetosphere and be observable as coherent radio emission. Our findings may lay the theoretical foundation for the interpretation of a plethora of observational phenomena seen in radio pulsars, magnetars, and possibly FRBs.

Track

Pulsars

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