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**Waves and rays in meta-microcavities: from positive “n” to negative “n” and from order to chaos<sup>1</sup>** NATALIA M. LITCHINITSER, SUNY at Buffalo, JORGE V. JOSE, Indiana University — The emergence of metamaterials and, in particular, negative index metamaterials (NIMs) triggers reconsideration of many fundamental physical phenomena. Importantly, the majority of unique properties of NIMs stand out when NIMs are combined with conventional positive index materials (PIMs). In this talk, we consider the wave and ray properties of electromagnetic wave interaction in two-dimensional microcavities that contain a combination of PIM and NIM with negative dielectric permittivity and magnetic permeability. We consider closed and open cavities and total and partial reflection and refraction at the boundaries between the media with different indices of refraction. By using a combination of analytic and numerical methods we are able to classify the different types of possible solutions in this type of mixed PIM-NIM regions. In particular, we derive the special properties of whispering gallery modes as well as the constructive and destructive interference due to wave refraction/reflection across different refractive media boundaries. Finally, we discuss possible practical applications of this type of mixed refractive indices microcavities.

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