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Photoluminescence properties of layered semiconductors under high pressure

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Summary *(400 caractères maxi)*

Semiconducting materials with a layered structure have emerged recently as well-adapted platforms to implement flexible optoelectronic devices and are of high interest for photovoltaic applications. Among them, perovskites have triggered a particular interest because of their very efficient absorption/emission properties. We propose to investigate optical properties of perovskites while changing the interlayer distance and effective coupling by applying high hydrostatic pressure.

Detailed subject *(1200 caractères maxi dont une figure possible)*

Layered materials under high pressure deform in a very particular way because of the strong crystal anisotropy. 2D perovskites are layered systems in which the number of active layers can be chosen when synthetizing the material, and the spacing between the perovskites structures can be tuned using different ligands. A hydrostatic pressure applied to layered materials mainly affects the van der Waals gap leaving the intralayer degree of freedom weakly affected. High pressure environments offer a way to tune the interlayer distance and the associated interlayer electrostatic or magnetic couplings. We have recently developed a unique experimental setup allowing for optical measurements in an extreme environment of low temperature (liquid helium), high magnetic field (to allow for Zeeman spectroscopy), and high hydrostatic pressure. We here propose to investigate these effects in these layered 2D perovskites with high potential for photovoltaic applications and to use these three extreme conditions to understand the influence of interlayer interaction of photoluminescence properties of 2D perovskites. This study will be in collaboration with the group F. Deschler, Heidelberg University, Germany.

Publications linked to the theme

A.Pawbake et al., ACS Nano **16**, 12656, (2022)

I. Breslavetz et al., Review of Scientific Instruments **92**, 123909, (2021)

Background and skills expected: The candidate should have a strong background in solid state physics, and should be highly motivated by experimental physics.

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