observation of highly excited excitons with principal quantum numbers up to $n = 25$, corresponding to a giant extension in the micrometer-range. Similar to Rydberg atoms they show huge interaction among each other leading to a Rydberg blockade effect. In magnetic field they allow one to enter the quantum chaos regime which for hydrogen atoms would require field strengths typical for white dwarf stars. We will also show high resolution results which demonstrate that the simple description of an exciton as hydrogen-like object breaks down in this case, as evidenced by a splitting of the exciton with a particular angular momentum quantum number.

Photoelastic resonances in phononic structures

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The field of optomechanics offers a rich variety of applications mostly based up to now onto the silicon platform in which nanofabrication techniques have reached a very high level of maturity. This technological choice has lead to consider a single dominant mechanism for the coupling between optical and mechanical degrees of freedom in micro- or nanoresonators, the so-called radiation pressure in which optical resonances are modified by the surface and interface displacements exclusively. More recently GaAs has been considered as an alternative choice of great potential in relation with the well established optoelectronic properties of direct gap semiconductors not available in silicon. In GaAs, radiation pressure has to be combined with a second mechanism, the photoelastic coupling which describes the modification of the dielectric properties in the bulk of the device in the presence of strain fields accompanying the mechanical behavior.

Optimizing optomechanical coupling in GaAs nanocavities thus does not rely only on increasing the confinement of optical and acoustic fields at the same location in the device [1], in other words in nanofabricating structures with high-quality factors for photons and phonons, it can also benefit from an optimization of the photoelastic coefficients in the constituting materials. Contrary to radiation pressure, photoelastic coupling indeed strongly depends on the wavelength of light involved in the experiments and, in particular, on its distance to intrinsic optical resonances in the material. Systematic studies of the photoelastic coupling thus appear of great interest in the new developing field of GaAs based optomechanical nanodevices.

We describe here resonant Brillouin scattering experiments in GaAs/AlAs multi-quantum wells and demonstrate that the confinement of carriers in quantum wells on one hand and the folding of acoustic phonons on the other hand lead to great simplifications in the theoretical treatment of the resonant scattering event and to great improvements in the experimental results. Based on a model for the acoustic light scattering by excitonic polaritons in structures containing an arbitrary finite number of quantum wells [2], we describe at the quantitative level and in the polaritonic picture all the rich experimental features displayed in the scattering spectra close to the lowest excitonic resonances in GaAs/AlAs multi-quantum wells. We demonstrate that such measurements and analysis can be applied in a large temperature range between 30 and 300 K and that quantitative determination of optical and optomechanical parameters can be deduced at unprecedented accuracy and completeness as compared to previous piezo-optical experiments.

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Топологические поляритонные моды в фотонных кристаллах

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Топологическими изоляторами называют материалы, которые внутри объема представляют собой диэлектрик, а на поверхности имеют устойчивые проводящие состояния [1]. В настоящее время происходит бурное развитие физики фотонных топологических изоляторов — нового типа фотонных кристаллов, являющихся аналогами электронных топологических изоляторов. Основным свойством таких систем является наличие в них краевых или поверхностных топологически защищенных оптических мод [2]. В докладе будет сделан обзор различных реализаций одномерных [3, 4, 5] и двумерных [6, 7, 8] фотонных топологических изоляторов. Подробно будет описана теория излучающих топологических состояний в структуре на основе периодической последовательности квантовых ям с несколькими ямами в элементарной ячейке [4]. В такой системе краевые оптические поляритонные моды имеют конечное радиационное время жизни, вызванное уходом света из структуры через ее края. Благодаря конечному радиационному затуханию таких топологических состояний, они проявляются в стационарных и разрешенных во времени спектрах