The sequence of nucleation events is modeled as a stochastic Markov process. The deviation from Poisson statistics is quantified by a single parameter γ, the ratio of the nucleation probabilities immediately before and after nucleation. The basis of our calculation is a self-consistent determination of the densities of probability of the nucleation probability, both when nucleation occurs and at an arbitrary instant. From these, we compute various quantities amenable to comparison with experiments or simulations.

Namely, we first derive the probability for having a given number of nucleations in a given time interval. As noted before, the distribution of these probabilities shows a marked narrowing with respect to Poisson statistics. We then calculate explicitly the standard deviation of this distribution, which quickly saturates as the length of the time interval increases. These results are compared with post-growth measurements. We also compute the distribution of the waiting times between nucleations, which could only be measured during growth.

We discuss how the computed quantities vary with parameter γ. We derive the actual values of γ for Au-catalyzed and self-catalyzed growth. A remarkable conclusion is that a marked narrowing of the distribution of the numbers of nucleations occurring in fixed time intervals [Fig. 2(a)] is fully compatible with a very broad distribution of waiting times [Fig. 2(b)]. This means that even strongly sub-Poissonian statistics do not at all imply that nucleation occurs in a quasi-periodic fashion. We discuss the implications of these findings for the realization of precisely controlled heterostructures in NWs.

I will finally consider the implications of these peculiar statistics on the formation of precisely controlled quantum structures in NWs.

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Rydberg excitons in cuprous oxide

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Cuprous oxide is the material in which excitons were discovered first by Evgenii Gross and Nury Karryjew in 1952. The energy levels of excitons typically can be well described by the hydrogen series. In the talk I will discuss the recent

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 quan-