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Bunching in Bosonic Cascades

T. C. H. Liew[1*], Y. G. Rubo[2], A. S. Sheremet[3,4], S. De Liberato[5], I. A. Shelykh[1,3,6], F. P. Laussy[4,7] and A. V. Kavokin[4,5,8,9]

[1]*Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore.*
[2]*Instituto de Energías Renovables, Universidad Nacional Autónoma de México, Morelos, Mexico.*
[3]*National University for Information Technology, Mechanics and Optics (ITMO), St.-Petersburg, Russia.*
[4]*Russian Quantum Center, Novaya 100, Skolkovo, Moscow Region, Russia.*
[5]*School of Physics and Astronomy, University of Southampton, Highfield, Southampton, UK.*
[6]*Science Institute, University of Iceland, Dunhagi-3, IS-107, Reykjavik, Iceland.*
[7]*Departamento de Física Teórica de la Materia Condensada and Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, E-28049, Spain.*
[8]*Spin Optics Laboratory, St.-Petersburg State University, 198504 Peterhof, St.-Petersburg, Russia*
[9]*CNR-SPIN, Viale del Politecnico 1, Rome I-00133, Italy.*

By merging the concepts of electronic quantum cascade lasers [1] and bosonic stimulation, a bosonic cascade laser was proposed a few years ago [2]. The device is based on a set of equidistant exciton states in a parabolic trapping potential, in which THz transitions between neighbouring levels are possible. Such transitions allow a cascade of multiple THz emission steps, theoretically allowing quantum efficiencies exceeding unity.

Here we extend previous theoretical work and study the quantum dynamics of bosonic cascades. By using stochastic Langevin equations, we demonstrate that bosonic cascades are able to produce extremely high values of photon bunching [3]. The peculiar nature of the system, where coherence is transferred between single states, accounts for superbunching, which develops in the phase where one condensate empties suddenly into the state below.

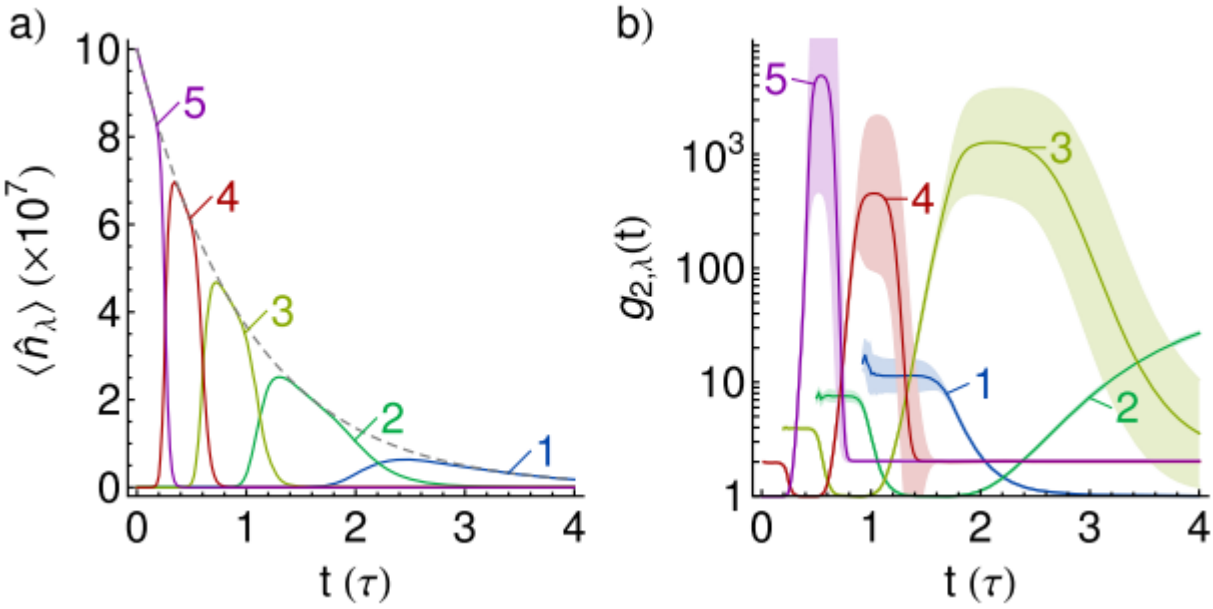

Figure 1. Evolution of five bosonic levels following a coherent pulsed excitation. (a) Average level occupations. (b) Second-order correlation function.

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[2] T. C. H. Liew, M. M. Glazov, K. V. Kavokin, I. A. Shelykh, M. A. Kaliteevski, and A. V. Kavokin, Phys. Rev. Lett., 110, 047402 (2012).
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