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Chromatic suppression of spontaneous emission

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Using reflecting boundary conditions, we can control the spontaneous emission of trapped $^{138}Ba^{+}$ ions. By reflecting the ion's fluorescence light onto itself, the single photons emitted by the ions interfere with the ions themselves, allowing control over the emission rate. The control is dependent on the solid angle at which the produced photons are retro-reflected, and in order to accomplish total control, we use a hemispherical mirror that can monitor the ion from every direction of space. When the mirror radius is tuned to achieve destructive interference at the wavelength of the produced photons, fluorescence, and hence the accompanying energy transition, can be prevented. Here, I describe our current efforts to control the decay of the $6p_{1/2}$ state of the $^{138}Ba^{+}$ ion, which can relax by emitting 493 nm or 650 nm photons. Our goal is to demonstrate control over the decay branching ratio, which could be useful in future studies, such as suppressing an undesired relaxation branch or simplifying the energy structure of ions.

Primary author: LAFENTHALER, Thomas

Co-authors: CERCHIARI, Giovanni; PANZL, Lorenz (Universität Innsbruck); BLATT, Rainer (Universität Innsbruck, Institut für Quantenoptik und Quanteninformation); MONZ, Thomas (University of Innsbruck); FAORLIN, Tommaso (Universität Innsbruck); WEISER, Yannick (University of Innsbruck)

Presenter: LAFENTHALER, Thomas

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