# Fano enhancement of SERS signal without increasing the hot spot intensity[1]

**Selen Postaci[1], Bilge Can Yildiz[2], Alpan Bek[1,3,4], Mehmet Emre Tasgin[5]**
*[1]Department of Physics, Middle East Technical University, 06800, Ankara, Turkey*
*[2] Physics Unit, Atilim University, 06836, Ankara, Turkey*
*[3]The Center for Solar Energy Research and Applications (GUNAM), Middle East Technical University, 06800, Ankara, Turkey*
*[4]Micro and Nanotechnology Program of Graduate School of Natural and Applied Sciences, Middle East Technical University, 06800, Ankara, Turkey*
*[5]Institute of Nuclear Sciences, Hacettepe University, 06800, Ankara, Turkey*

saatci@metu.edu.tr

## Abstract

Nanostructures enhance nonlinear response, such as surface enhanced Raman scattering (SERS), by localizing the incident field into hot spots[2]. In a double resonance scheme, this localized field can be enhanced even further when linear Fano resonances take place[3,4]. However, some limitations prevent revealing of this further increase at the hot spot intensity. These could be modification of the vibrational modes, break-down of the molecule or reaching to tunneling regime. Our method, which can circumvent these limitations, show that the enhancement of the localized field can be multiplied by a factor of $10^2$-$10^3$, even when the field intensity at the hot spot remains unchanged. This can be achieved by utilizing a path interference scheme in the nonlinear response[5]. In an analytical model, we demonstrate that enhancement takes place due to cancellation of the contributing terms in the denominator of the expression for the SERS response. We demonstrate that (i) hot spot intensity does not change and (ii) SERS signal increases by $10^2$-$10^3$ with the exact solutions of the 3D Maxwell equations.

**References:**

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