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We connect three phenomena of wave packet dynamics: Talbot images, revivals of a particle in a box, and fractional revivals. The physical origin of these effects is deeply rooted in phase factors which are quadratic in a quantum number leading to Gauss sums familiar from number theory. We show that the characteristic structures and the time evolution of these systems allow us to factorize large integers. Moreover, we show that two-photon transitions in atoms driven by a chirped laser pulse also lead to Gauss sums. We also discuss the influence of entanglement in these schemes. In particular we report on a NMR experiment using this technique which has factored a six digits number.

References:

- M. Berry, I. Marzoli, and W.P. Schleich, *Physics World*, 14 (6) 39-44 (2001)  
H. Mack, M. Bienert, F. Haug, F.S. Straub, M. Freyberger, and W.P. Schleich, in: *Experimental Quantum Computation and Information*, edited by F. DeMartini and C. Monroe (Elsevier, Amsterdam 2002)  
H. Mack, M. Bienert, F. Haug, M. Freyberger, and W.P. Schleich, *Physics Status Solidi (B)* 233 (3) 408-415 (2002)  
W. Merkel, Ilya Averbukh, B. Girard, G. Paulus, and W.P. Schleich, *Factorization of numbers with physical systems, Fortschritte der Physik, Special Issue (54)}*, 856-865 (2006)