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### Proof of standard security analysis compatibility with a sub-carrier wave quantum communication method

The field of quantum communication and key distribution (QKD) is reaching its maturity, opening the door to commercially available systems and quantum networks. For secure optical networking applications, the sub-carrier wave (SCW) QKD systems demonstrate some important advantages, in particular high spectral efficiency, polarization independence, and unidirectionality. However, currently there is no strict proof of security presented for this class of QKD systems due to an uncommon way of generating the quantum signal in them. In SCW systems, phase modulation of a high-intensity signal produces the quantum signal at its spectral sidebands. We investigate the properties of quantum signals in a SCW system using the theory of electro-optical modulators in order to prove that the standard security analysis can be applied. We consider both classical and two quantum approaches: with finite and infinite number of interacting modes. We discuss how to estimate the number of interacting modes and how a finite number of them affects on the modulation process. Knowing how the quantum states develop due to modulation, we derive an equation for quantum interpretation of the second order correlation function for both sidebands. We then demonstrate that the second order correlation function equals unity, and thus both sidebands can be interpreted as one coherent state with double mean photon number compared to one sideband. Therefore, we for the first time demonstrate that the quantum channel in the SCW system satisfies the conditions of the standard (for example, Inamori-Lutkenhaus-Mayers or Gottesman-Lo-Lutkenhaus-Preiskill) security analysis for QKD with coherent states source.

### Biography

Andrei Gaidash received two MS degrees in Photonics and Optical Information Technologies at ITMO University (Russia) and University of Rochester (USA) in 2015. He is currently a first year Post-graduate student at ITMO University. His research interests include quantum information and communication technologies.

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