The geometry of black holes can be viewed as if space were a medium moving towards their singularities. Where the flow becomes superluminal such that nothing can escape, horizons are formed. Laboratory analogues of black holes are based on this picture [1]. In particular, in one-dimensional waveguides horizons can be formed around refractive index perturbations that travel at the speed of light in the medium. In the frame moving with the perturbation, the medium is 'flowing' by at the speed of light.

A black hole emits waves in thermal equilibrium [2]. The waves consist of correlated pairs of quanta, one from the inside and one from the outside of the horizon. Therefore, on one side of the horizon, the gravitational black hole emits thermal black-body radiation, Hawking radiation [2].

In our analogue system we use the nonlinear optics of light pulses in fibers. A stable soliton pulse is propagating down an optical fiber. It perturbs the refractive index $n$ of the fiber due to the Kerr effect. We present results of the interaction of a probe wave with these artificial horizons. For these waves the pulse presents a moving potential barrier. For a sufficient barrier height, a turning point or group velocity horizon is established and the wave is frequency shifted at the pulse. If the input mode is in the vacuum state, mode conversion is still expected as the production of photon pairs at the horizon. This is a manifestation of the analogue of the Hawking effect in fibers. We present the current status of the experiment for the production of these photon pairs.

References