**TEST OF OPTICAL STOCHASTIC COOLING IN FERMILAB**

**Abstract:**

New 150 MeV dual-purpose electron storage ring is being built at Fermilab. It is aimed for tests of integrable optics and optical stochastic cooling (OSC). This paper discusses OSC, its major parameters and incoming experimental tests of the optical amplifier prototype based on light amplification in highly doped Ti-sapphire crystal.

**Summary:**

The stochastic cooling has been successfully used in a number of machines for particle cooling and accumulation. Cooling rates of few hours required for luminosity control in hadron colliders cannot be achieved in the microwave frequency range (~1-10 GHz) usually used in stochastic cooling. Large longitudinal particle density used in such colliders requires an increase of cooling bandwidth by a few orders of magnitude. To achieve such increase one needs to make a transition to much higher frequencies. A practical scheme operating in the optical frequency range was suggested in Ref. [1]. The method is named the optical stochastic cooling (OSC). It is based on the same principles as the stochastic cooling but uses much higher frequencies. Thus it is expected to have a bandwidth of ~100 THz and can create a way to attain required damping rates. Fermilab plans to make an experimental test of the OSC in IOTA ring [2].

In the OSC a particle emits e.-m. radiation in the first (pickup) wiggler. Then, the radiation amplified in an optical amplifier (OA) makes a longitudinal kick to the same particle in the second (kicker) wiggler. A magnetic chicane is used to make space for the OA and to delay a particle so that to compensate for a delay of its radiation in the OA resulting in simultaneous arrival of the particle and its amplified radiation to the kicker wiggler. Optics of the ring was specially designed to maximize the cooling ranges for both the longitudinal and horizontal degrees of freedom. The vertical degree of freedom is cooled due to strong x-y coupling.

[1] M. S. Zolotorev and A. A Zholents, Phys. Rev. E, 50, 4, p. 3087 (1994).  
[2] S. Nagaitsev, et. al., p.16, IPAC-2012, (2012).