1145-65-2720 **Luan Vu Thai*** (vluan@smu.edu), Department of Mathematics, Southern Methodist University, Dallas, TX. *Exponential integrators for stiff PDEs and their application to atmospheric models.* Preliminary report.

In this talk, we first introduce exponential Rosenbrock methods, which are designed for large stiff PDEs. They are fully explicit and do not suffer from the stability restriction imposed by the CFL condition for the linear part. It has been also shown that these integrators can offer much higher accuracy than implicit/IMEX methods, and can offer significant computational savings, particularly for large systems where no efficient preconditioner is available. For the accuracy and efficiency purposes, we identify the three efficient schemes of orders 4 and 5 (exprb42, pexprb43, exprb53). Then we apply these schemes to a suite of four challenging tests problems performed with the shallow water equations on the sphere, which are commonly used to test and design atmospheric models. Moreover, we propose an efficient modification of one of state-of-the-art algorithms for the implementation of exponential integrators. Altogether, this allows the proposed schemes enable accurate solutions at much longer time-steps than previous methods including the widely used semi-implicit schemes, proving considerably more efficient as the desired accuracy decreases or as the problem nonlinearity increases. This offers a good potential for the new methods to be used in meteorological models. (Received September 25, 2018)