Anomalous Velocity Dependence of the Friction Coefficient of an Air Supported Pulley MATTEO CRISMANI, MICHAEL NAUENBERG, Physics Dept., UCSC — A standard undergraduate lab exercise to verify Newton's law, F = ma, is to measure the acceleration a of a glider of mass m suspended on an air track. In our experiment the glider is accelerated by a thin tape attached to the glider at one end, and to a weight of mass M at the other end. The weight hangs vertically via a pulley over which the tape is suspended by air pressure. In the absence of friction, the force pulling the glider is F = (M m/(M + m))g, where g is the acceleration of gravity. To the accuracy provided by the fast electronic timers (accurate to 1/10000 second) used in our experiment to measure the velocity and the acceleration of the glider, we verified that the friction due to the air track can be neglected. But we found that this is not the case for the friction due to the air pulley which adds a component -v/T to the force F on the glider, where T is the friction coefficient. We have measured the dependence of this coefficient on v, and found an excellent analytic fit to our data. This fit deviates considerable from the conventional assumption that 1/T is a constant and/or depends linearly on v.

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