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TITLE OF THE PAPER:

Drop dynamics experiments: Ground-based and flight results

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DESCRIPTION:

1 he dynamics of the oscillatory and rotational behavior of free drops and shells have been experimentally investigated using levitation methods both in Earth-based laboratories as well as during Spacelab missions. Recently obtained data from the Sl"S-50 flight are now available for a comparison with ground-based results in order to isolate the specific effects of gravity from the action of the levitation and positioning techniques. A soft nonlinearity in the oscillatory dynamics of free drops has been amply documented by ground-based experiments, and they are in qualitative agreement with numerical model predictions. A comparison with the information obtained from acoustically positioned drops in microgravity will be carried out in order to obtain a quantitative evaluation of the deviation from both 1 G results as well as theoretical predictions. Other specific areas of interest are the natural free decay oscillatory behavior (modal composition and nonlinear response), the frequencies of the resonant mode of oscillations of rotating drops, the equilibrium shape of rotating drops, and the oscillatory and rotational dynamics of liquid shells. Preliminary analysis has revealed that the rotational behavior of simple drops is qualitatively similar in 1 G and in microgravity: the rotational velocity characteristic of transition from the axisymmetric to the two-lobed geometry of a rotating drop depends on the initial static distortion, and the behavior of an undistorted drop can be extrapolated from that of a distorted one, a case which is successfully predicted by numerical modelling and verified by space-based data. Because of the obvious mass unbalance in 1 G, the case for liquid shells appears more interesting, especially in regards to the oscillatory dynamics, and it may constitute a more fruitful area of investigation for future microgravity experiments.