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PROGRESS REPORT II ON THE DEVELOPMENT OF A METHOD TO DETECT FRACTIONAL CHARGES IN WATER.

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Since the previous progress report on the project CERN/ISR/70-33 Add. 1 of October 1st 1971, and the report given at the ISRC meeting of February 23 1972, the work on the development of the method has been actively continued.

The full scale setup of 5 meter height with the observation chamber at the top for the observation of the droplets at the apogee of the water jet is ready with its vacuum system. Various difficulties have however been encountered with the jet which has made it necessary in particular to try to understand theoretically as well as experimentally the as yet little studied phenomena of droplet formation and droplet propagation in a vacuum with and without an electric field. During the past year the experimental work has in particularly been devoted to the diagnostic methods and instrumentation, necessary to observe the phenomena. It is not a trivial problem to observe the detailed behaviour of the 10 micron diameter droplets, moving at high speed inside a vacuum system. Considerable progress has been made after we have equipped ourselves with large focal length microscope, and a sub-microsecond stroboscopic illumination system. When the latter is synchronised to the ultrasonic vibrations which steer the rate of droplet formation, we obtain still pictures of the droplets in the beam which show that under suitable conditions it is possible to obtain very fine beams where the lateral spread of the droplets without electric field is only 5 microns at a distance of 30 cm from the origin of the jet. This spread is of the order expected from the Brownian

motion given to the droplets as they leave the jet. Attempts to observe separations of charges in the microscope when a field of 12 kV/cm was applied across a 20 cm length, the jet were not successful. This is not surprising however, since we expect theoretically even for uncharged beams to have an initial deflèction of the droplets by the dipole-dipole interaction between droplets, due to the dielectic moments induced in the droplet by the electric fièld. This interaction is initially repulsive and will make the jet unstable. It will however quickly disappear as the beam increasees in diameter. Because of this effect it is probably necessary to use the originally foreseen full scale, 5 m system to observe separation of elementary charges.

While under idèal conditions the results are thus very promising for the success of the method, these ideal conditions seem to require particular combinations for the various parameter of the method, such as the frequency of droplet formation, speed of the jet, properties of the liquid, and the characteristics of the capillary being used for producing the jet. The effect of these parameters, which sometimes is quite critical, is at present not well understood, but with the improved diagnostic and observational methods now at our disposal we have good hope to arrive at a satisfactory result in a not too distant future.

While we are not at present in a position to make a definite request for an irradiation at the ISR as described in our proposal, we would therefore want to confirm that our intention to do the experiment is still unchanged, and we would like to ask the ISRC to keep our proposal among the pending proposals.