Comment on L. Holmlid, *Int. J. Mass Spec.* **352** (2013) 1

Klavs Hansen
Department of Physics, University of Gothenburg,
41296 Gothenburg, Sweden

In a recent article [1] Holmlid measures mass spectra and kinetic energies from hydrogen-based materials. These results have been used as support for recent claims of fusion processes in a table-top device [2]. It is no exaggeration to say that these claims, if correct, will have a revolutionary impact on global energy production and human civilization. Also claims of superfluidity and room-temperature superconductivity makes it relevant to examine the empirical foundations on which they build, including the small amount of quantitative information on the mass spectra given in [1].

Briefly, the experiments measured the flight time of mass peaks as a function of a variable voltage bias on the ion source. The data pertaining to the most intense peaks in fig.4 of [1] have been summarized in Table 1 of that article and used by the authors to assign a mass and a kinetic energy release to the peaks.

This is possible in principle with the chosen experimental procedure, although the peaks are so broad that serious difficulties will arise in the assignment of accurate parameters to the spectra. If one nevertheless uses the data given in the article, viz. the flight times at the rising edge of the signal, the particle mass and the kinetic energy release can be determined with the formula

$$\frac{m}{2q}v^2 = U_b + \frac{1}{q}E_k, \tag{1}$$

where m is the mass, v the speed, q the charge, U_b the bias voltage, and E_k the kinetic energy release. The plot of U_b vs. v^2 is ideally a straight line with a slope of $m/2q$ and intercept $-E_k/q$.

The fitted parameters are $m = 1.16 m_{\mathrm{H}}$ and $E_k = 130$ eV (see Fig. 1). In [1] the peak is assigned to the deuterium ion, in obvious contradiction with the data. The erroneous mass assignement requires that the kinetic energy release is assigned arbitrary values to produce the observed flight times. This is accomplished by assuming that the measured values depend on the mass spectrometer setting and varies from 570 eV to 155 eV when the bias potential is changed from 500 to 0 V.

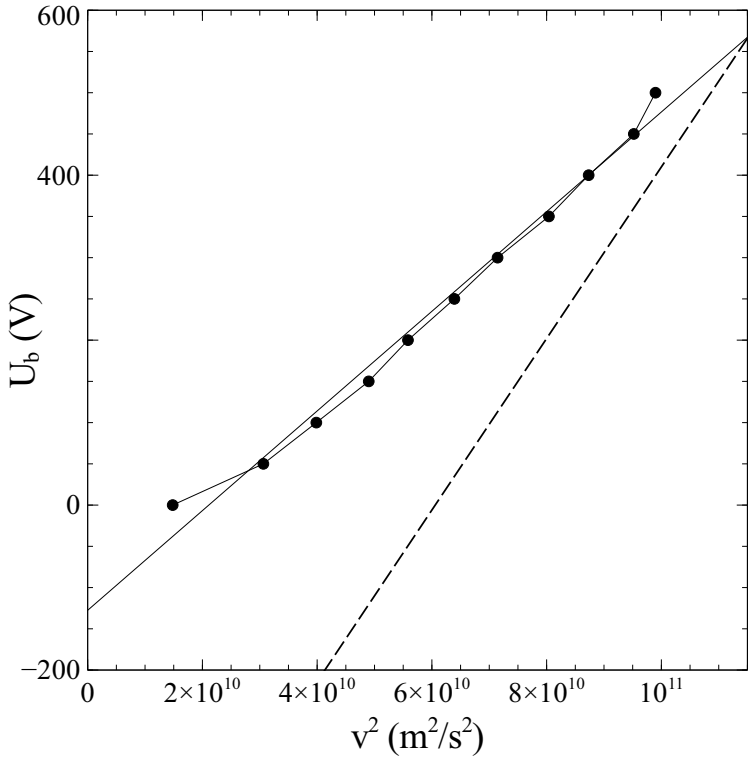

Figure 1: Plot of bias potential vs. v^2, calculated from the measured flight times. The full line is a linear fit to the data. The dashed line is the expected line for a deuterium ion produced with a kinetic energy release of 630 eV.

The explanation suggested for this peculiar behavior in [1] is that a fraction of the kinetic energy release is deposited in rotational excitations of a putative D_2 molecule some time during the ion production process. The assigned kinetic energy and the rotational energy, which is suggested to amount to several hundred eV, supposedly add up to 630 eV, which is the value the author expects from considerations that are not made explicit in the article (for unknown reasons it adds up to 650 eV for the 150 and 200 V bias potentials). It is not explained neither how a single atom can carry internal rotational energy of several hundred eV, nor how a relatively modest and macroscopic source bias potential can change the properties of the presumed picometer-sized particles.

In summary, an arbitrary mass and a number of arbitrary kinetic energies have been assigned to rather broad peaks observed in a mass spectrometer. A simple re-analysis of the data shows that the peaks are those of protons, produced with a significantly

smaller and bias-independent kinetic energy release than given in [1]. The origin of the protons is most likely a contamination of the source material. The far-reaching conclusions made by the author appear to rest on very shaky grounds.

References

[1] L. Holmlid, *Int. J. Mass Spec.* **352** (2013) 1

[2] L. Holmlid, *AIP Advances* **5** (2015) 087129