Supplemental material to: "Pairing-gap, pseudo-gap, and no-gap phases in rf spectra of a trapped unitary ^{6}Li gas"

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Comparison at high temperatures

To test the evolution of the pseudo-gap phase and its fate with increasing temperature, we report in Figs.S1(a) and S1(b) the rf spectra taken at temperatures $0.6T_F$ and $1.2T_F$, respectively, with the corresponding DOS and DOS+AL calculations appropriate to the normal phase.

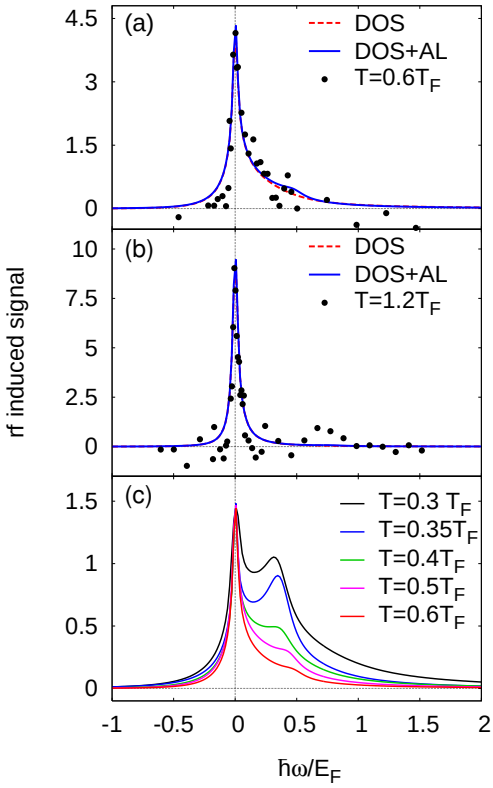

Figure S1: Temperature evolution of the rf spectra of a trapped unitary ^{6}Li gas. Experimental spectra (circles) for (a) $T = 0.6T_F$ and (b) $T = 1.2T_F$ are compared with theoretical calculations which include (DOS+AL) or neglect (DOS) final-state effects. In (c) the temperature evolution of the theoretical spectra evidences the progressive disappearance of the two-peak structure for increasing temperature (here, the spectra were rescaled to share the height of the left peak).

The peak at larger frequencies associated with the pseudo-gap phase is seen to disappear for increasing temperature, while the remaining peak at zero detuning looses its pronounced asymmetry toward high frequencies. To evidence this effect more clearly, we report in Fig.S1(c) a theoretical DOS+AL calculation for five temperatures in the normal phase between $0.3T_F$ and $0.6T_F$, where the progressive disappearance of the peak at larger frequencies for increasing temperature results evident.

The slow frequency tail of the DOS calculation

A comment is in order about the comparison which results in Fig.3 of the main text, between the experimental data and the DOS calculation (that neglects final-state effects). At a first sight it may, in fact, look like that the DOS calculation by itself could account for the overall features that are present in the experimental data.

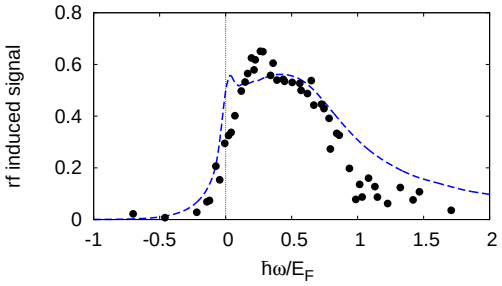

Figure S2: The dashed line represents the DOS calculation of Fig.3 of the main text, while the circles are the corresponding experimental data that have been rescaled vertically as to match the theoretical curve near $0.5E_F$.

However, the comparison reported in Fig.S2 shows that, if one tries to match the theoretical DOS curve and the experimental data near the main structure at $0.5E_F$ by rescaling the experimental data, one ends up with a tail of the DOS calculation (which decays rather slowly like $\omega^{-3/2}$) that considerably overestimates the wing of the experimental data. In addition, the DOS calculation misses the structure of the main peak at low energy.

A slow frequency tail resulted already in the theoretical approaches of Refs.[1, 2] which did not include final-state

effects. It is only with the subsequent inclusion of final-state effects [3, 4] (which make the tail of the rf spectra to decays faster like $\omega^{-5/2}$ and pile up the oscillator strength toward threshold at the same time) that one is able to reproduce *not only* the main structure at $0.5E_F$ *but also* the tail of the experimental data, as shown explicitly in Fig.3 of the main text.

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