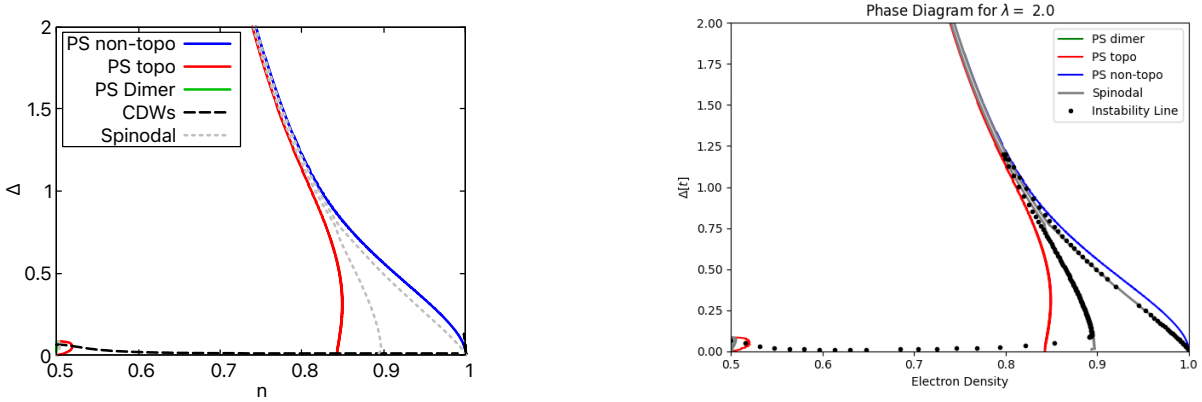
Correction of the Instability Line in the Phase Diagrams

1 Correction of the Instability Line in the Phase Diagrams

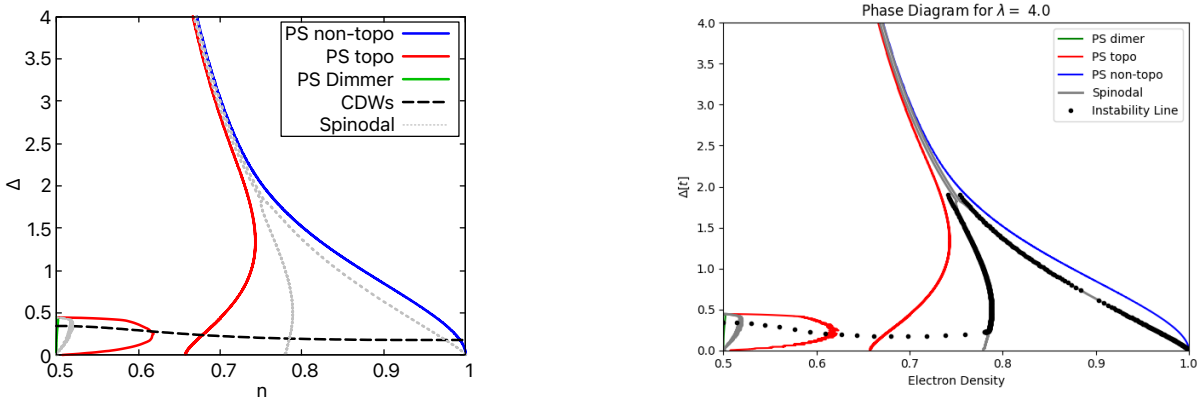
The instability line previously identified as the *CDW line* in the phase diagrams for $\lambda > 0$ was found to be incorrect. This line was initially computed using an algorithm based on the physical understanding available at that time. However, by re-evaluating the problem and examining each point in the Δ vs. n grid, we found that the actual instability line follows a different path.

Below, we compare the original phase diagrams with the revised ones. The old diagrams (left) contain the previously assumed instability line, while the corrected versions (right) show the properly computed instability line.



(a) Original diagram – $\lambda = 2.0$ (b) Corrected diagram – $\lambda = 2.0$

Figure 1: Comparison between original (left) and corrected (right) instability lines for Case 1.



(a) Original diagram – $\lambda = 4.0$ (b) Corrected diagram – $\lambda = 4.0$

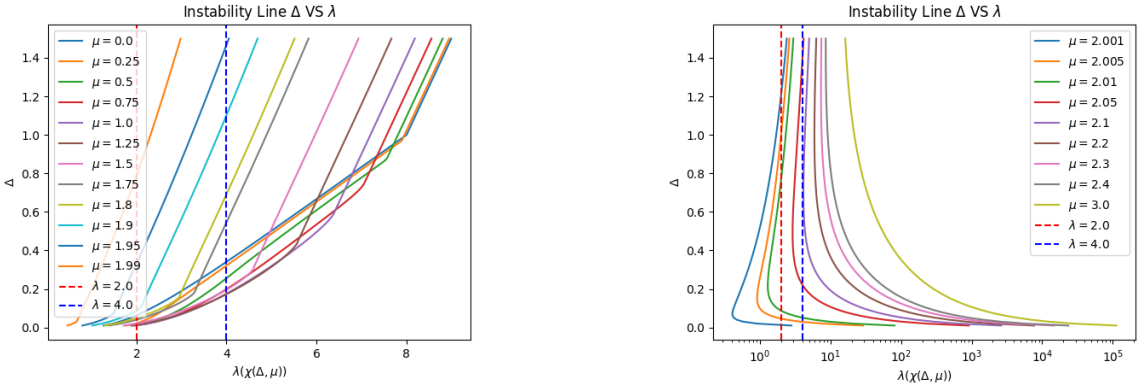
Figure 2: Comparison between original (left) and corrected (right) instability lines for Case 2.

In conclusion, the instability line, after a critical electron density, follows the spinodal line of the non-topological homogeneous phase.

2 Understanding better the slope change in the Δ vs $\lambda(\chi_{RPA})$

- Hypothesis 1: The point where there is a discontinuity in the slope for each μ, is the point where the system reaches the spinodal line of the non-topological homogeneous phase.
- Hypothesis 2: Extending on Hypothesis 1: The Instability line is the spinodal line of the Homogeneous Phase

Make reference in the following figures:



(a) $\mu < 2$ (b) $\mu > 2$

Figure 3: Instability Line in Δ vs λ diagram. The instability occurs when the RPA susceptibility diverges, i.e., when $1 - \lambda/2 \cdot \chi(\Delta, \mu) = 0$