

# Unified picture of Q-balls and boson stars via catastrophe theory

Takashi Tamaki (Nihon university)

in collaboration with Nobuyuki Sakai (Yamagata University)

TT & N. Sakai:PRD81, 124041(2010)  
and recent progress

Q-balls & boson stars  $\rightarrow$  dark matter candidates  
discussed separately!!

As for stability, gravitating Q-balls are similar to boson stars.

## In the thick-wall limit

Boson stars  $V(\phi) = \frac{m^2}{2}\phi^2 + \lambda\phi^4 \rightarrow$  stable

Q-balls (without gravity)  $V_4(\phi) := \frac{m^2}{2}\phi^2 - \lambda\phi^4 + \frac{\phi^6}{M^2}$  with  $m^2, \lambda, M > 0$   
 $\rightarrow$  unstable

With gravity

(even extremely weak)  $\rightarrow$  become stable!!

# No. 73