Review Saclay approach

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December 12, 2022

UNIÓN EUROPEA
FONDO EUROPEO DE DESENVOLVEMENTO REXIONAL
"Unha maneira de facer Europa"

Work done in collaboration with Jean-Paul Blaizot

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- Discussed in Blaizot and Escobedo, 2021.

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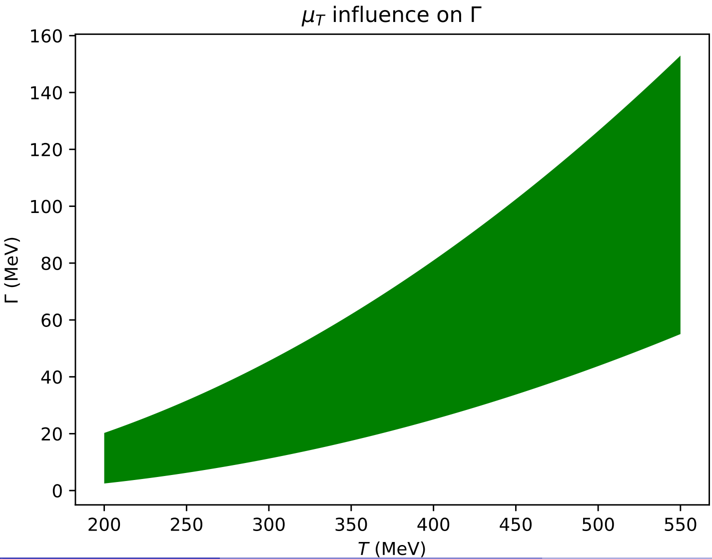
- We take into account the effects of the energy gap between singlets and octets.
- For the real part of the potential we consider two scenarios. HTL and a lattice inspired scenario.
- The decay width comes from a HTL computation using as input the binding energy and wave function of the singlet.

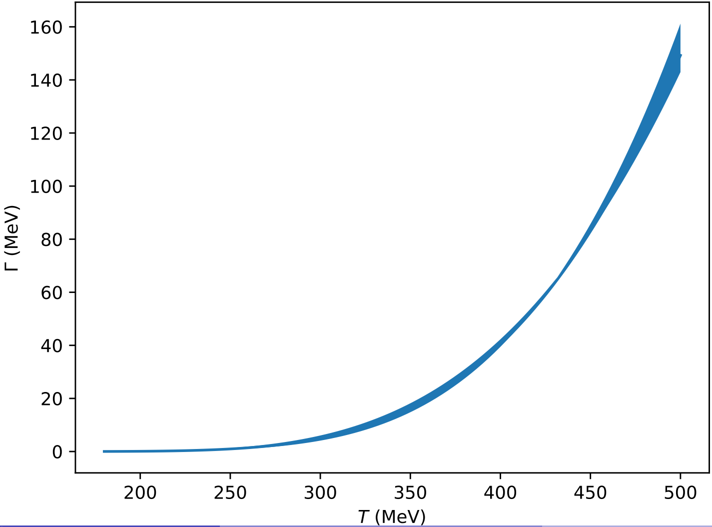
Decay vs T

Perturbative case



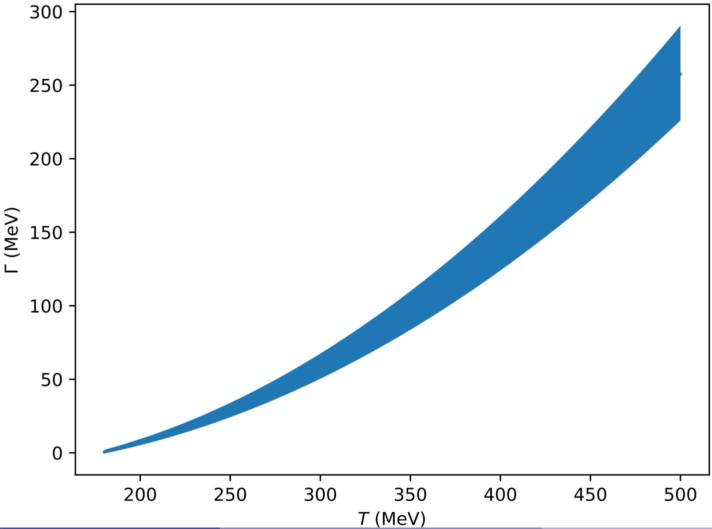
Decay vs T

Lattice inspired scenario. $\Upsilon(1S)$



Decay vs T

Lattice inspired scenario. $\Upsilon(2S)$



Masses and binding energies

Perturbative case

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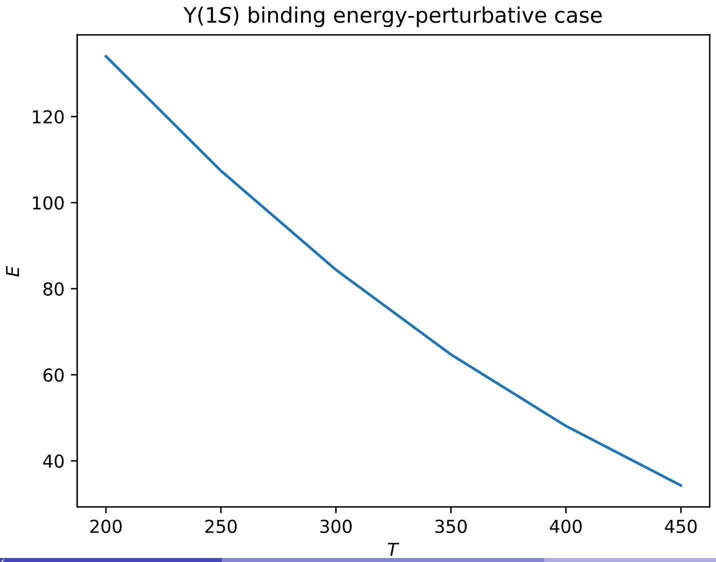
- We solve the Schrödinger equation with the real part of the HTL potential and from there we obtain the binding energy.

Masses and binding energies

Perturbative case



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Lattice inspired scenario

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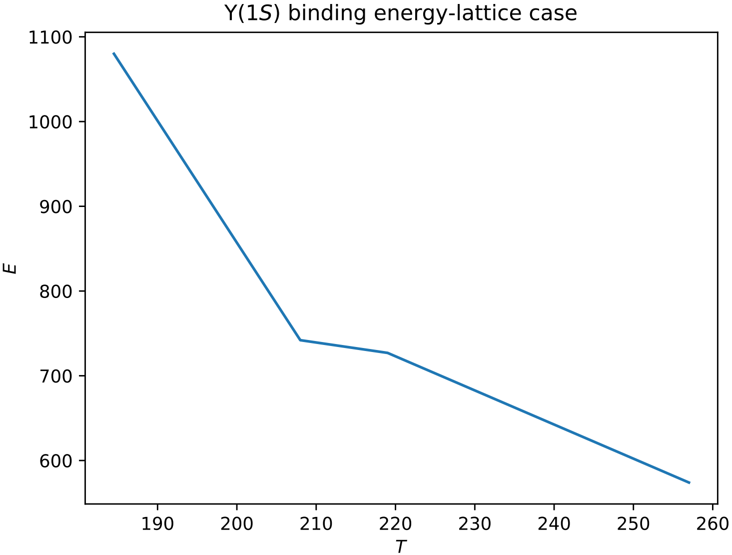
Masses and binding energies

Lattice inspired scenario

- We use $M_b = 4882\, MeV$.
- This is the mass used in the paper from which we get the static potential data (Rothkopf and Lafferty, 2020) to reproduce bottomonium spectroscopy.
- As real potential, we use a parametrization that was shown in (Rothkopf and Lafferty, 2018) to reproduce the static potential within errors.

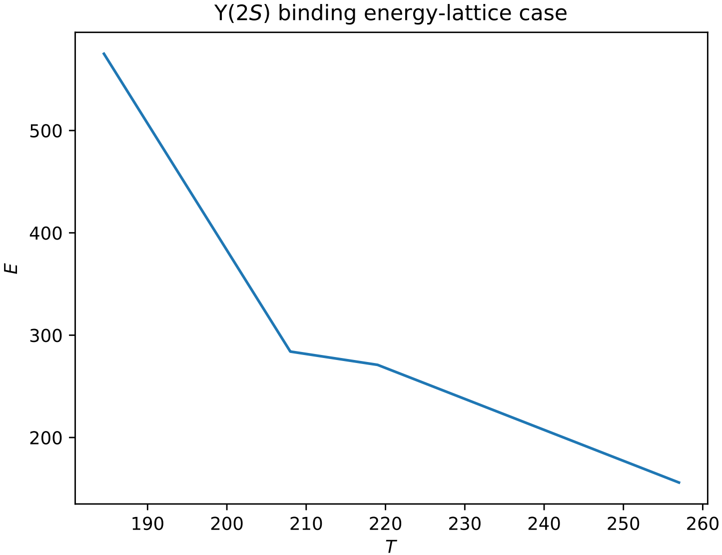
Masses and binding energies

Lattice inspired scenario. $\Upsilon(1S)$



Masses and binding energies

Lattice inspired scenario. $\Upsilon(2S)$



Gamma vs p

We do not include p dependence in our approach. Hence, Γ depends only on temperature.

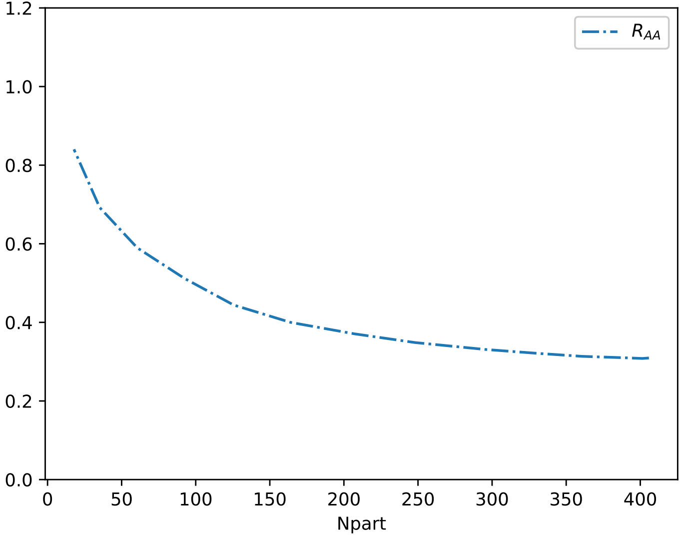
T	$\Upsilon(1S)$ perturbative	$\Upsilon(1S)$ lattice	$\Upsilon(2S)$ lattice
200	6.52	0.0889	7
300	19.54	4.96	58.5
400	40.45	40.4	142

R_{AA} for fixed Γ

$$\Gamma = \begin{cases} 0 & T < 200\ MeV \\ \frac{T}{2} - 100\ MeV & T > 200\ MeV \end{cases}$$

- Bjorken evolution.
- Glauber model.
- Initial temperature scales with the number of participants.

R_{AA} for fixed Γ



R_{AA} vs p

We do not include p dependence in our model. However, we can compute R_{AA} in the given centrality window

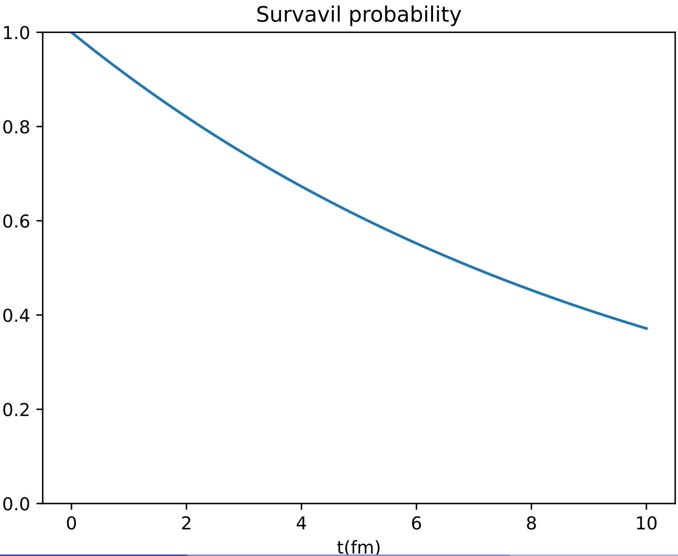
$$R_{AA}|_{0-10\,centrality} = 0.32$$

Survival probability

- $T = 300\, MeV$
- Initial state is a medium $\Upsilon(1S)$ state.

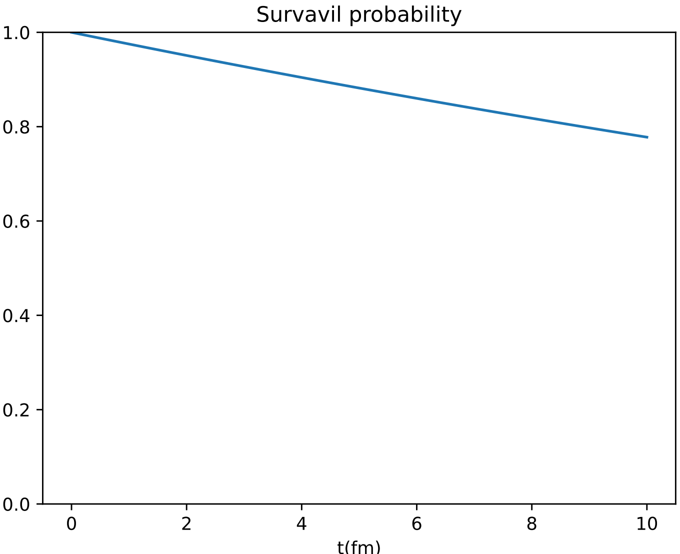
Survival probability

Perturbative case



Survival probability

Lattice inspired scenario



Vacuum state transition

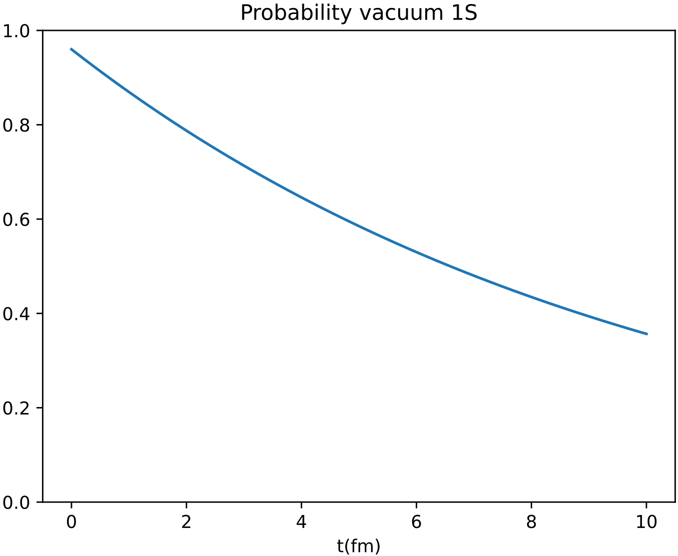
Perturbative case

We computed numerically the overlap between Yukawa potential eigenvectors and Coulomb ones.

Lattice inspired scenario

- We could not directly compare with the $T = 0$ eigenvectors in an easy way. Our code is set to work with potentials that go zero at infinity, which is not the case of the Cornell potential.
- Then we compare with a very small temperature in which medium effects are very mild.
- We see that medium and vacuum eigenvectors are almost identical at the given temperature.

Vacuum state transition



Vacuum state transition