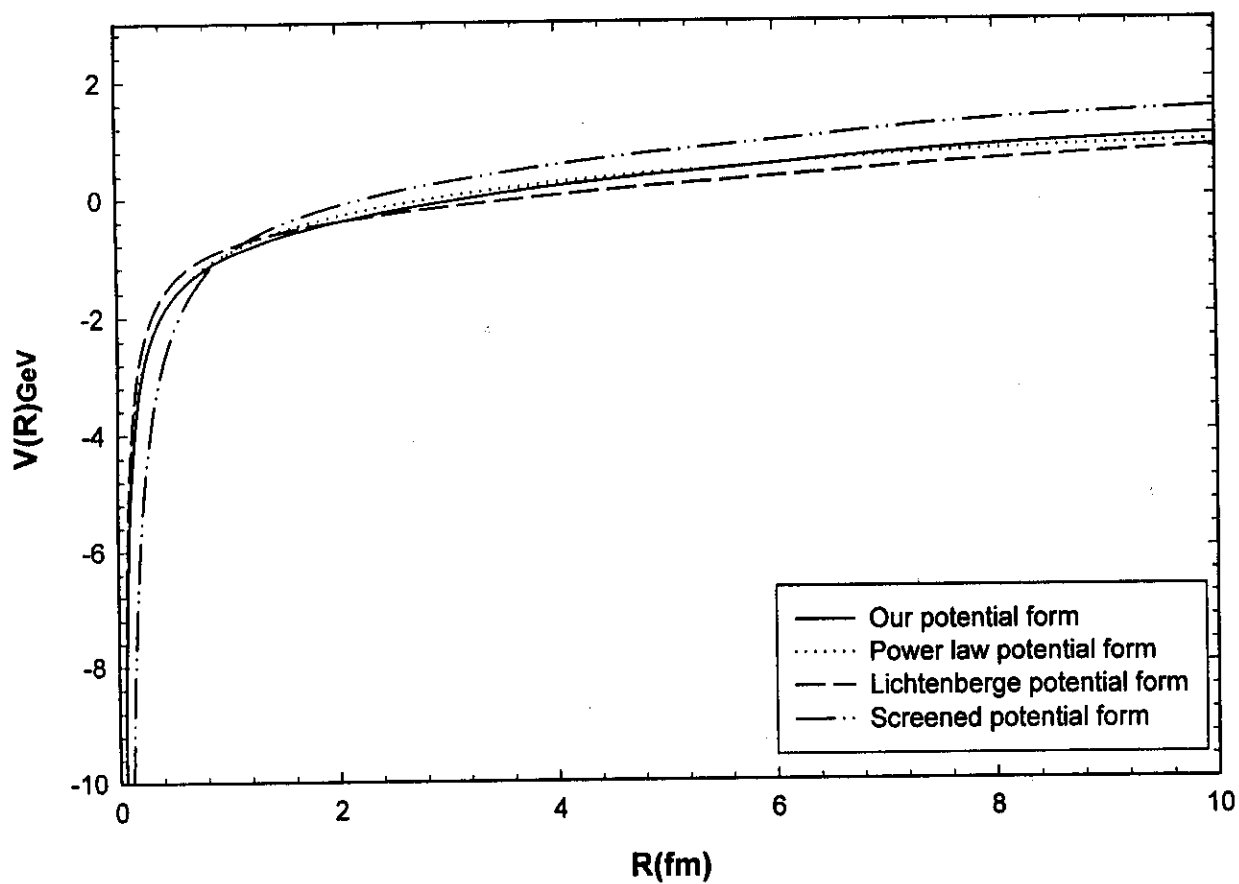




Fig(3-1): The behavior of different potential models.

Table (3-1): Parameters of the used potentials

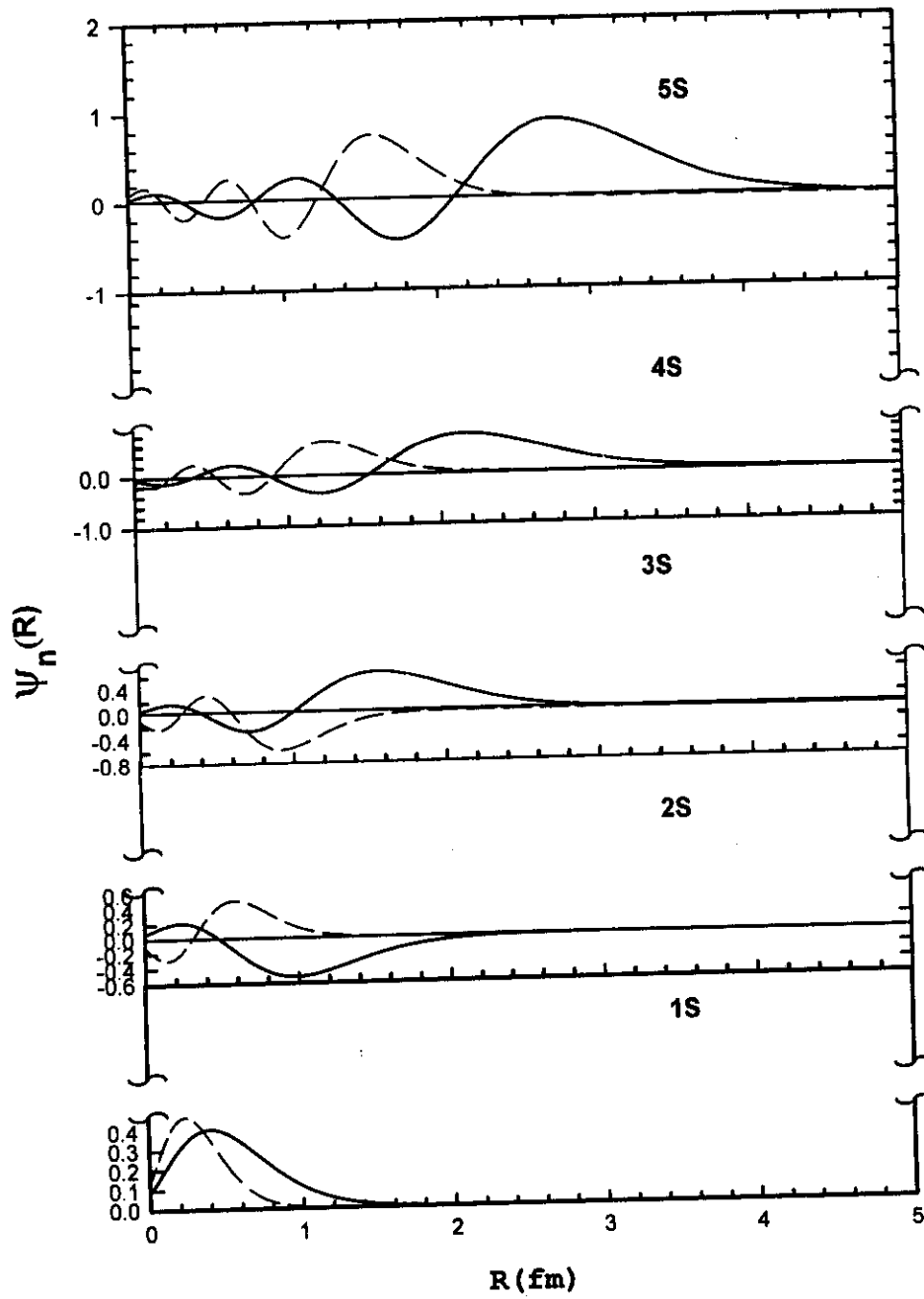
Parameters	Potentials			
	Lichtenberg	Power law	Screened	Present form
$m_c(\text{GeV})$	1.638 ± 0.046	1.545 ± 0.025	1.483 ± 0.056	1.55 ± 0.07
$m_b(\text{GeV})$	5.04 ± 0.02	4.96 ± 0.04	4.983 ± 0.11	5.013 ± 0.06
$m_s(\text{GeV})$	0.45 ± 0.05	0.5 ± 0.1	0.44	0.4
$m_u(\text{GeV})$	0.2	0.2	0.3	0.35
A_s	0.01	0.01	0.001	0.2
a	0.7	-	-	-
b	0.24	-	-	-
C	-0.39	-0.807	-	5.614
λ	-	0.85	-	-
α	-	-0.1	-	-
α_s	-	-	0.61	-
T	-	-	0.18	-
μ	-	-	0.11	-

Table (3-2): The present calculations of $c\bar{c}$ mass spectra with MeV, in comparison with other theoretical models and experimental data.

State	Lichtenberg	Power law	Screened form	Present form	Exp. data [62,63]
$1^1S_0(\eta_c)$	2981.1	2976.0	2979.0	2977.9	2979.6 ± 1.6
1^3S_1	3095.9	3096.0	3097.8	3096.2	3096.93 ± 0.1
1^3P_0	3415.0	3416.8	3415.3	3415.0	3415.1 ± 1.0
1^3P_1	3509.4	3512.2	3510.7	3510.5	3510.6 ± 0.5
$1^3P_2(\chi_c)$	3553.0	3552.6	3555.2	3556.7	3556.3 ± 0.4
2^1S_0	3592.3	3597.7	3597.8	3595.3	3594.0 ± 5.0
2^3S_1	3685.8	3686.0	3687.0	3685.7	3686.0 ± 0.1
2^3P_0	3790.4	3809.9	3764.1	3882.8	
2^3P_1	3882.8	3893.3	3857.4	3964.9	
2^3P_2	3925.0	3909.8	3901.7	3988.2	
3^1S_0	3938.9	3938.3	3882.6	3998.4	
3^3S_1	4036.9	4036.8	4040.5	4040.4	4040.0 ± 10.0
4^1S_0	4215.5	4161.8	4095.4	4282.0	
4^3S_1	4166.3	4177.8	4166.0	4159.6	4159.0 ± 20.0
5^3S_1	4403.1	4408.5	4416.3	4414.6	4415.0 ± 6.0
χ^2	18.9	19.3	18.4	6.4	

Table (3-3): The present calculations of $b\bar{b}$ mass spectra with MeV, in comparison with other theoretical models and experimental data.

State	Lichtenberg	Power law	Screened form	Present form	Exp. Data [62,63]
$1^1S_0(\eta_b)$	9451.5	9111.0	9076.4	9112.7	
1^3S_1	9461.8	9460.5	9459.7	9459.8	9460.3 ± 0.2
1^3P_0	9859.9	9855.1	9859.2	9859.6	9859.8 ± 1.3
1^3P_1	9892.8	9888.3	9892.6	9890.4	9891.9 ± 0.7
$1^3P_2(\chi_b)$	9913.8	9913.4	9913.3	9913.6	9913.2 ± 0.6
2^1S_0	10020.1	9895.5	9935.1	9860.8	
2^3S_1	10022.2	10021.7	10023.1	10023.5	10023.3 ± 0.3
2^3P_0	10238.5	10234.3	10234.9	10234.4	10235.3 ± 1.1
2^3P_1	10250.8	10258.4	10254.6	10254.7	10255.2 ± 0.4
2^3P_2	10269.4	10269.6	10269.0	10268.5	10269.0 ± 0.7
3^1S_0	10328.0	10275.0	10279.6	10263.3	
3^3S_1	10353.4	10353.9	10356.4	10355.8	10355.3 ± 0.5
4^1S_0	10558.1	10521.1	10507.9	10544.2	
4^3S_1	10583.8	10577.2	10584.8	10581.3	10580.0 ± 3.5
5^3S_1	10860.1	10869.4	10872.7	10872.5	10865.0 ± 8.0
χ^2	19.8	13.0	1.9	1.5	



Fig(3-2):S- wave functions for $c\bar{c}$ and $b\bar{b}$ system by using our potential form. The solid line for $c\bar{c}$,and the dashed line for $b\bar{b}$

Table (3-4): The present calculations of cs mass spectra with MeV, in comparison with other theoretical models and experimental data.

State	Lichtenberg	Power law	Screened form	Ref [47]	Present form	Exp [64]
1^1S_0	1968.1	1972.4	1968.5	2009.0	1969.3	1968.0
1^3S_1	2111.7	2108.6	2109.0	2110.0	2110.9	2110.0
1^3P_0	2493.2	2540.0	2748.5	2514.0	2565.8	
1^3P_1	2522.6	2558.7	2752.3	2550.0	2770.9	
1^3P_2	2573.5	2568.0	2756.4	2622.0	2794.5	
2^1S_0	2580.3	2650.6	2838.5	2778.0	2815.0	
2^3S_1	2597.2	2692.6	2887.1	2805.0	2833.8	
2^3P_0	2907.0	2924.9	3191.6	3065.0	3036.7	
2^3P_1	2949.5	2944.1	3194.1	3072.0	3236.9	
2^3P_2	3028.0	2957.5	3196.7	3068.0	3250.9	
3^1S_0	3057.2	2969.1	3253.7	3264.0	3280.0	
3^3S_1	3244.5	2996.9	3285.1	3277.0	3291.2	

Table (3-5): The present calculations of $b\bar{s}$ mass spectra with MeV, in comparison with other theoretical models and experimental data.

State	Lichtenberg	Power law	Screened form	Ref [47]	Present form	Exp [64]
1^1S_0	5377.1	5374.1	5371.0	5298.0	5375.3	5375.0
1^3S_1	5422.9	5336.2	5382.4	5409.0	5458.9	
1^3P_0	5808.4	5779.5	6117.8	5927.0	5902.5	
1^3P_1	5821.6	5807.9	6122.3	6009.0	5916.9	
1^3P_2	5840.2	5815.5	6126.9	6173.0	5944.5	
2^1S_0	5952.0	5902.4	6241.9	6264.0	6123.1	
2^3S_1	6047.1	5937.4	6246.2	6299.0	6131.2	
2^3P_0	6189.5	6160.9	6578.4	6561.0	6371.4	
2^3P_1	6209.5	6190.0	6581.2	6580.0	6379.9	
2^3P_2	6243.6	6202.4	6584.3	6618.0	6396.4	
3^1S_0	6380.2	6453.6	6665.2	6764.0	6539.3	
3^3S_1	6426.0	6487.4	6667.8	6777.0	6525.4	

Table (3-6): The present calculations of $\bar{b}u$ mass spectra with MeV, in comparison with other theoretical models and experimental data.

State	Lichtenberg	Power law	Screened form	Ref [47]	Present form	Exp [64]
1^1S_0	5283.8	5280.8	5284.5	5094.0	5280.8	5279.0
1^3S_1	5355.0	5369.5	5354.3	5265.0	5352.9	5352.0
1^3P_0	5692.4	5693.2	6085.4	5798.0	5821.5	
1^3P_1	5766.8	5761.9	6089.4	5904.0	5832.3	
1^3P_2	5789.8	5781.8	6093.6	6116.0	5853.2	
2^1S_0	5840.9	5746.1	6204.9	6192.0	6034.5	
2^3S_1	6006.2	5819.4	6220.9	6224.0	6037.0	
2^3P_0	6061.3	6079.3	6552.1	6515.0	6293.9	
2^3P_1	6150.9	6148.6	6554.7	6537.0	6300.3	
2^3P_2	6204.7	6172.4	6557.4	6585.0	6312.7	
3^1S_0	6228.9	6193.9	6633.4	6732.0	6409.9	
3^3S_1	6468.2	6277.3	6643.5	6747.0	6435.4	

Table (3-7): The present calculations of $c\bar{b}$ mass spectra with MeV, in comparison with other theoretical models .

State	Lichtenberg	Power law	Screened form	Ref [47]	Present form
1^1S_0	6243.9	5913.6	6313.7	6256.0	6104.5
1^3S_1	6257.6	6276.7	6319.1	6314.0	6311.0
1^3P_0	6659.1	6634.9	6859.9	6709.0	6619.7
1^3P_1	6686.7	6727.9	6865.5	6755.0	6672.1
1^3P_2	6689.4	6838.0	6866.0	6847.0	6751.3
2^1S_0	6780.0	6865.9	6951.9	6929.0	6819.2
2^3S_1	6788.7	6891.8	6957.3	6968.0	6917.3
2^3P_0	7012.7	7041.9	7204.5	7156.0	7085.2
2^3P_1	7038.6	7118.9	7210.0	7169.0	7119.2
2^3P_2	7041.0	7199.4	7240.9	7195.0	7167.5
3^1S_0	7109.0	7200.0	7273.2	7308.0	7220.6
3^3S_1	7116.4	7214.2	7279.2	7326.0	7287.2