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NLO-NLL Higgsino-like Cross Sections (non-fully-degenerate case)

The following cross sections are for pure higgsino-like pair production. They differ from the fully-degenerate case because here not all of the higgsinos are assumed to have the same mass, but there is a mass splitting between the two lightest neutralinos of $\Delta M = m(\tilde{\chi}_2^0) - m(\tilde{\chi}_1^0)$, and the mass of the lighter chargino is half-way in between the two neutralinos, $m(\tilde{\chi}_1^\pm) = m(\tilde{\chi}_1^0) + \Delta M/2$. These NLO+NLL cross-sections were computed using Resummino and an envelope of the CTEQ6.6 and MSTW2008nlo90cl PDFs. In addition, a dedicated calculation of the branching ratios (BR) of the $\tilde{\chi}_2^0$ into two leptons and the $\tilde{\chi}_1^\pm$ into a lepton and neutrino (including the tau lepton(s) where possible) was done with SUSYHit. In this calculation the decays of $\tilde{\chi}_2^0$ into $\tilde{\chi}_1^\pm + X$ or $\tilde{\chi}_1^0 + \gamma$ are not allowed. The values are listed in the tables below.

When using these cross sections, please cite the following two references, available below in bibtex format:

Show References Hide References


```
@article{Fuks:2012qx,
      author         = "Fuks, Benjamin and Klasen, Michael and Lamprea, David R.
                        and Rothering, Marcel",
      title          = "{Gaugino production in proton-proton collisions at a
                        center-of-mass energy of 8 TeV}",
      journal        = "JHEP",
      volume         = "10",
      pages          = "081",
      doi            = "10.1007/JHEP10(2012)081",
      year           = "2012",
      eprint         = "1207.2159",
      archivePrefix  = "arXiv",
      primaryClass   = "hep-ph",
      reportNumber   = "IPHC-PHENO-12-07, MS-TP-12-05",
      SLACcitation   = "%%CITATION = ARXIV:1207.2159;%%",
}

@article{Fuks:2013vua,
      author         = "Fuks, Benjamin and Klasen, Michael and Lamprea, David R.
                        and Rothering, Marcel",
      title          = "{Precision predictions for electroweak superpartner
                        production at hadron colliders with {\sc Resummino}}",
      journal        = "Eur. Phys. J. C",
      volume         = "73",
      pages          = "2480",
      doi            = "10.1140/epjc/s10052-013-2480-0",
      year           = "2013",
      eprint         = "1304.0790",
      archivePrefix  = "arXiv",
      primaryClass   = "hep-ph",
      reportNumber   = "CERN-PH-TH-2013-064, IPHC-PHENO-13-02, MS-TP-13-06",
      SLACcitation   = "%%CITATION = ARXIV:1304.0790;%%",
}
```


Two SLHA templates are attached that have been used in the cross-section calculations:

- N2N1, N2C1p, N2C1m: higgsino_slha.in
- C1C1: higgsino_slha_C1C1.in (Technical remark: The masses of some of the decoupled SUSY particles are set to less extreme (i.e. somewhat lower) mass values in this SLHA file to avoid crashes in loop calculations.)

C1pN2 ($\tilde{\chi}_1^+\tilde{\chi}_2^0$) Higgsino production

Show table Hide table

$m(\tilde{\chi}_2^0)$ [GeV]	$m(\tilde{\chi}_1^\pm)$ [GeV]	$m(\tilde{\chi}_1^0)$ [GeV]	xsec [pb]	relative uncertainty
100	50	0	9.09558	0.02231
100	55	10	8.20626	0.02198
125	70	15	3.51078	0.02294
100	60	20	7.40862	0.02171
125	75	25	3.25252	0.02315
125	80	35	3.01338	0.02338
100	70	40	6.06053	0.02178
150	95	40	1.59392	0.02558
125	85	45	2.7925	0.02361
150	100	50	1.49736	0.02585
150	102.5	55	1.45133	0.02598
100	80	60	5.00771	0.02106
120	90	60	2.83624	0.02290
150	105	60	1.40672	0.02609
150	110	70	1.32168	0.02626
81.5	80.75	80	7.47073	0.01914
82	81	80	7.34199	0.01992
83	81.5	80	7.08993	0.02006
85	82.5	80	6.62058	0.02022
90	85	80	5.61532	0.02072
95	87.5	80	4.80271	0.02120
100	90	80	4.13934	0.02170
110	95	80	3.13403	0.02266
120	100	80	2.42578	0.02363
140	110	80	1.53031	0.02552
200	145	90	0.48446	0.03125
101.5	100.75	100	3.30590	0.02181
102	101	100	3.26241	0.02254
103	101.5	100	3.17638	0.02264
105	102.5	100	3.01358	0.02279
110	105	100	2.65145	0.02327
115	107.5	100	2.34357	0.02378
120	110	100	2.08078	0.02425
130	115	100	1.65896	0.02520
140	120	100	1.34117	0.02615
150	125	100	1.09847	0.02722
160	130	100	0.90709	0.02798
200	150	100	0.46223	0.03154
200	152.5	105	0.45152	0.03169
200	155	110	0.44107	0.03184
200	160	120	0.42083	0.03193
126.5	125.75	125	1.50030	0.02484
127	126	125	1.48393	0.02570
128	126.5	125	1.45393	0.02579
130	127.5	125	1.39465	0.02598
135	130	125	1.25940	0.02644

140	132.5	125	1.14041	0.02690
145	135	125	1.03536	0.02736
155	140	125	0.85959	0.02827
165	145	125	0.71995	0.02917
185	155	125	0.51616	0.03096
152	151	150	0.78365	0.02876
153	151.5	150	0.76995	0.02887
155	152.5	150	0.74360	0.02903
160	155	150	0.68252	0.02947
165	157.5	150	0.62755	0.02991
170	160	150	0.57814	0.03036
180	165	150	0.49299	0.03123
190	170	150	0.42304	0.03210
200	175	150	0.36609	0.03274
210	180	150	0.31662	0.03381
250	200	150	0.18794	0.03712
250	202.5	155	0.18438	0.03726
250	205	160	0.1809	0.03740
250	210	170	0.17414	0.03772
178	176.5	175	0.44809	0.03085
180	177.5	175	0.43479	0.03104
185	180	175	0.40360	0.03146
190	182.5	175	0.37514	0.03189
195	185	175	0.34914	0.03231
205	190	175	0.30448	0.03405
202	201	200	0.28275	0.03454
203	201.5	200	0.27896	0.03458
205	202.5	200	0.27160	0.03479
210	205	200	0.25423	0.03520
215	207.5	200	0.23820	0.03561
220	210	200	0.22341	0.03603
230	215	200	0.19674	0.03683
240	220	200	0.17444	0.03765
250	225	200	0.1554	0.03841
260	230	200	0.13801	0.03924
300	252.5	205	0.08818	0.04243
300	255	210	0.08675	0.04254
300	260	220	0.08398	0.04281
230	227.5	225	0.17820	0.03663
235	230	225	0.16787	0.03704
240	232.5	225	0.15826	0.03743
255	240	225	0.13367	0.03946
252	251	250	0.12566	0.03992
253	251.5	250	0.12428	0.03997
255	252.5	250	0.12157	0.04015
260	255	250	0.11511	0.04054
265	257.5	250	0.10884	0.04089
270	260	250	0.10339	0.04131
280	265	250	0.09289	0.04203
290	270	250	0.08400	0.04283

C1pN2 () Higgsino production

300	275	250	0.07619	0.04353
310	280	250	0.06884	0.04431
350	310	270	0.04478	0.04772
302	301	300	0.06350	0.04495
303	301.5	300	0.06290	0.04502
305	302.5	300	0.06172	0.04517
310	305	300	0.05888	0.04553
315	307.5	300	0.05606	0.04593
320	310	300	0.05366	0.04625
340	320	300	0.04489	0.04770
360	330	300	0.0377	0.04923
special masses				
120	105	100	2.24473	0.02393
120	115	100	1.92858	0.02456
120	120	100	1.78996	0.02488
160	152.5	150	0.70118	0.02934
160	157.5	150	0.66301	0.02963
160	160	150	0.64482	0.02978

C1mN2 ($\tilde{\chi}_1^- \tilde{\chi}_2^0$) Higgsino production

Show table Hide table

$m(\tilde{\chi}_2^0)$ [GeV]	$m(\tilde{\chi}_1^\pm)$ [GeV]	$m(\tilde{\chi}_1^0)$ [GeV]	xsec [pb]	relative uncertainty
100	50	0	5.96450	0.04259
100	55	10	5.35753	0.04274
125	70	15	2.20607	0.04484
100	60	20	4.81553	0.04293
125	75	25	2.03535	0.04509
125	80	35	1.87795	0.04535
100	70	40	3.90292	0.04330
150	95	40	0.96063	0.04761
125	85	45	1.73315	0.04560
150	100	50	0.89905	0.04786
150	102.5	55	0.86978	0.04799
100	80	60	3.20454	0.04146
120	90	60	1.76639	0.04383
150	105	60	0.84150	0.04812
150	110	70	0.78778	0.04840
81.5	80.75	80	4.86322	0.03940
82	81	80	4.77871	0.04012
83	81.5	80	4.60766	0.04015
85	82.5	80	4.28971	0.04049
90	85	80	3.61176	0.04109
95	87.5	80	3.06705	0.04170
100	90	80	2.62492	0.04227
110	95	80	1.96067	0.04343
120	100	80	1.49791	0.04452
140	110	80	0.92186	0.04664
200	145	90	0.27153	0.05299
101.5	100.75	100	2.07213	0.04294

102	101	100	2.04474	0.04326
103	101.5	100	1.98820	0.04338
105	102.5	100	1.88132	0.04361
110	105	100	1.64452	0.04419
110	105	100	1.64371	0.04410
115	107.5	100	1.44431	0.04472
120	110	100	1.27430	0.04529
130	115	100	1.00358	0.04630
140	120	100	0.80173	0.04728
150	125	100	0.64742	0.04919
160	130	100	0.52999	0.04925
200	150	100	0.25824	0.05329
200	152.5	105	0.25183	0.05338
200	155	110	0.24560	0.05349
200	160	120	0.23362	0.05376
126.5	125.75	125	0.90218	0.04670
127	126	125	0.89246	0.04680
128	126.5	125	0.87300	0.04695
130	127.5	125	0.83544	0.04715
135	130	125	0.75003	0.04765
140	132.5	125	0.67527	0.04815
145	135	125	0.60959	0.04863
155	140	125	0.50049	0.04957
165	145	125	0.41465	0.05049
185	155	125	0.29122	0.05226
152	151	150	0.45364	0.05006
153	151.5	150	0.44524	0.05020
155	152.5	150	0.42907	0.05033
160	155	150	0.39173	0.05078
165	157.5	150	0.35829	0.05123
170	160	150	0.32836	0.05166
180	165	150	0.27714	0.05252
190	170	150	0.23543	0.05334
200	175	150	0.20128	0.05449
210	180	150	0.17280	0.05492
250	200	150	0.09860	0.05784
250	202.5	155	0.09659	0.05793
250	205	160	0.09463	0.05804
250	210	170	0.09082	0.05823
178	176.5	175	0.25022	0.05271
180	177.5	175	0.24231	0.05292
185	180	175	0.22381	0.05330
190	182.5	175	0.20701	0.05368
195	185	175	0.19173	0.05407
205	190	175	0.16529	0.05543
202	201	200	0.15307	0.05557
203	201.5	200	0.15089	0.05558
205	202.5	200	0.14663	0.05579
210	205	200	0.13661	0.05616
215	207.5	200	0.12741	0.05652

220	210	200	0.11895	0.05688
230	215	200	0.10383	0.05751
240	220	200	0.09123	0.05825
250	225	200	0.08037	0.05891
260	230	200	0.07093	0.05955
300	252.5	205	0.04367	0.06220
300	255	210	0.04291	0.06230
300	260	220	0.04142	0.06250
230	227.5	225	0.09328	0.05768
235	230	225	0.08749	0.05800
240	232.5	225	0.08212	0.05834
255	240	225	0.06835	0.05978
252	251	250	0.06412	0.06009
253	251.5	250	0.06336	0.06007
255	252.5	250	0.06188	0.06027
260	255	250	0.05834	0.06058
265	257.5	250	0.05493	0.06077
270	260	250	0.05197	0.06118
280	265	250	0.04631	0.06169
290	270	250	0.04155	0.06233
300	275	250	0.03729	0.06308
310	280	250	0.03352	0.06344
350	310	270	0.02099	0.06619
302	301	300	0.03072	0.06391
303	301.5	300	0.03040	0.06396
305	302.5	300	0.02979	0.06407
310	305	300	0.02831	0.06433
315	307.5	300	0.02684	0.06467
320	310	300	0.02561	0.06485
340	320	300	0.02104	0.06618
360	330	300	0.01741	0.06725
special masses				
120	105	100	1.38092	0.04493
120	115	100	1.17681	0.04565
120	120	100	1.08784	0.04601
160	152.5	150	0.40332	0.05067
160	157.5	150	0.38002	0.05096
160	160	150	0.36894	0.05110

N2N1 ($\tilde{\chi}_2^0\tilde{\chi}_1^0$) Higgsino production

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$m(\tilde{\chi}_2^0)$ [GeV]	$m(\tilde{\chi}_1^\pm)$ [GeV]	$m(\tilde{\chi}_1^0)$ [GeV]	xsec [pb]	relative uncertainty
100	80	60	7.61302	0.02396
120	90	60	4.50471	0.02546
81.5	80.75	80	7.74623	0.02308
82	81	80	7.64634	0.02394
83	81.5	80	7.45084	0.02409
85	82.5	80	7.07968	0.02417
90	85	80	6.24893	0.02456

95	87.5	80	5.53691	0.02499
100	90	80	4.92469	0.02532
110	95	80	3.93372	0.02611
120	100	80	3.18028	0.02680
140	110	80	2.14215	0.02824
101.5	100.75	100	3.20125	0.02627
102	101	100	3.16995	0.02694
103	101.5	100	3.10963	0.02702
105	102.5	100	2.99358	0.02724
110	105	100	2.72555	0.02743
115	107.5	100	2.48571	0.02791
120	110	100	2.27127	0.02814
130	115	100	1.90521	0.02896
140	120	100	1.60839	0.02944
160	130	100	1.16590	0.03099
126.5	125.75	125	1.38358	0.02982
127	126	125	1.37316	0.03033
128	126.5	125	1.35226	0.03053
130	127.5	125	1.31280	0.03066
135	130	125	1.21990	0.03099
140	132.5	125	1.13461	0.03132
145	135	125	1.05624	0.03165
155	140	125	0.91781	0.03230
165	145	125	0.80028	0.03294
185	155	125	0.61470	0.03422
152	151	150	0.69993	0.03371
153	151.5	150	0.69128	0.03370
155	152.5	150	0.67448	0.03389
160	155	150	0.63450	0.03421
165	157.5	150	0.59717	0.03449
170	160	150	0.56244	0.03482
180	165	150	0.49963	0.03540
190	170	150	0.44489	0.03602
210	180	150	0.35498	0.03719
178	176.5	175	0.39165	0.03627
180	177.5	175	0.38342	0.03637
185	180	175	0.36371	0.03668
190	182.5	175	0.34513	0.03696
195	185	175	0.32763	0.03725
202	201	200	0.24030	0.03953
203	201.5	200	0.23805	0.03953
205	202.5	200	0.23362	0.03969
210	205	200	0.22295	0.03996
215	207.5	200	0.21282	0.04018
220	210	200	0.20321	0.04048
230	215	200	0.18536	0.04095
240	220	200	0.16938	0.04152
260	230	200	0.14182	0.04253
230	227.5	225	0.15019	0.04177
235	230	225	0.14399	0.04203

240	232.5	225	0.13808	0.04234
252	251	250	0.10281	0.04455
253	251.5	250	0.10202	0.04451
255	252.5	250	0.10045	0.04469
260	255	250	0.09666	0.04492
265	257.5	250	0.09296	0.04502
270	260	250	0.08954	0.04538
280	265	250	0.08293	0.04577
290	270	250	0.07698	0.04628
310	280	250	0.06636	0.04715
302	301	300	0.05032	0.04892
303	301.5	300	0.04999	0.04896
305	302.5	300	0.04933	0.04904
310	305	300	0.04772	0.04925
315	307.5	300	0.04611	0.04932
320	310	300	0.04467	0.04965

C1pC1m ($\tilde{\chi}_1^+\tilde{\chi}_1^-$) Higgsino production

Show table Hide table

$m(\tilde{\chi}_2^0)$ [GeV]	$m(\tilde{\chi}_1^\pm)$ [GeV]	$m(\tilde{\chi}_1^0)$ [GeV]	xsec [pb]	relative uncertainty
100	80	60	6.66416	0.02753
120	90	60	4.33863	0.02894
81.5	80.75	80	6.45989	0.02651
82	81	80	6.36642	0.02766
83	81.5	80	6.22325	0.02773
85	82.5	80	5.95066	0.02788
90	85	80	5.33559	0.02823
95	87.5	80	4.80263	0.02859
100	90	80	4.33874	0.02894
110	95	80	3.57416	0.02963
120	100	80	2.97766	0.03031
140	110	80	2.12956	0.03164
101.5	100.75	100	2.90885	0.02975
102	101	100	2.87461	0.03045
103	101.5	100	2.82433	0.03051
105	102.5	100	2.73447	0.03065
110	105	100	2.51066	0.03098
115	107.5	100	2.30973	0.03131
120	110	100	2.12956	0.03164
130	115	100	1.81974	0.03229
140	120	100	1.56587	0.03288
160	130	100	1.17988	0.03417
126.5	125.75	125	1.32785	0.03289
127	126	125	1.31864	0.03365
128	126.5	125	1.29653	0.03374
130	127.5	125	1.26094	0.03386
135	130	125	1.17722	0.03417
140	132.5	125	1.10282	0.03447
145	135	125	1.03212	0.03478

155	140	125	0.90717	0.03537
165	145	125	0.80077	0.03596
185	155	125	0.63158	0.03714
152	151	150	0.69316	0.03666
153	151.5	150	0.68496	0.03675
155	152.5	150	0.66905	0.03683
160	155	150	0.63127	0.03711
165	157.5	150	0.59608	0.03739
170	160	150	0.56342	0.03767
180	165	150	0.50442	0.03822
190	170	150	0.45304	0.03877
210	180	150	0.36841	0.03983
178	176.5	175	0.39597	0.03885
180	177.5	175	0.38795	0.03895
185	180	175	0.36877	0.03923
190	182.5	175	0.35075	0.03948
195	185	175	0.33382	0.03974
202	201	200	0.24621	0.04195
203	201.5	200	0.24396	0.04201
205	202.5	200	0.23956	0.04210
210	205	200	0.22897	0.04234
215	207.5	200	0.21894	0.04258
220	210	200	0.20947	0.04282
230	215	200	0.19203	0.04329
240	220	200	0.17625	0.04376
260	230	200	0.14927	0.04467
230	227.5	225	0.15567	0.04387
235	230	225	0.14943	0.04409
240	232.5	225	0.14348	0.04435
252	251	250	0.10732	0.04651
253	251.5	250	0.10651	0.04650
255	252.5	250	0.10492	0.04663
260	255	250	0.10105	0.04684
265	257.5	250	0.09736	0.04701
270	260	250	0.09383	0.04726
280	265	250	0.08722	0.04765
290	270	250	0.08117	0.04808
310	280	250	0.07052	0.04888
302	301	300	0.05317	0.05050
303	301.5	300	0.05282	0.05054
305	302.5	300	0.05213	0.05061
310	305	300	0.05047	0.05080
315	307.5	300	0.04886	0.05104
320	310	300	0.04733	0.05117

Branching ratios for $\tilde{\chi}_2^0 \rightarrow \ell\ell\tilde{\chi}_1^0$ and $\tilde{\chi}_1^{\pm} \rightarrow \ell\nu\tilde{\chi}_1^0$

Show table Hide table

$\Delta M(\tilde{\chi}_2^0, \tilde{\chi}_1^0)$ [GeV]	$BR(\tilde{\chi}_2^0 \rightarrow ee\tilde{\chi}_1^0)$	$BR(\tilde{\chi}_2^0 \rightarrow \mu\mu\tilde{\chi}_1^0)$	$BR(\tilde{\chi}_2^0 \rightarrow \tau\tau\tilde{\chi}_1^0)$	$BR(\tilde{\chi}_2^0 \rightarrow \ell\ell\tilde{\chi}_1^0)$	$BR(\tilde{\chi}_1^{\pm} \rightarrow e\nu\tilde{\chi}_1^0)$	$BR(\tilde{\chi}_1^{\pm} \rightarrow \mu$

1.0	0.05292	0.04979	0.00000	0.10271	0.20804	0.16782
1.5	0.05112	0.04981	0.00000	0.10093	0.20375	0.18498
2.0	0.05087	0.04881	0.00000	0.09968	0.20220	0.19140
3.0	0.05016	0.04924	0.00000	0.09940	0.20100	0.19610
5.0	0.04714	0.04681	0.00471	0.09866	0.17790	0.17630
10.0	0.04285	0.04279	0.02670	0.11235	0.13180	0.13150
20.0	0.03801	0.03800	0.03385	0.10985	0.11660	0.11650
40.0	0.03537	0.03537	0.03482	0.10556	0.11253	0.11251
60.0	0.03498	0.03498	0.03458	0.10454	0.11170	0.11170

AlexanderMann - 2019-03-07

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