

原子分子イオンの衝突に関する調査と 低電離 W イオンの電荷変化断面積

京都大学大学院工学研究科 伊藤秋男

委託研究 原子・分子・イオンの衝突に関する調査

(文献調査・データシート作成)

(電荷変化断面積測定)

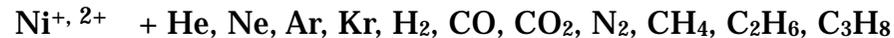
平成6年度まで



平成7~9年度 低電離金属イオンの電荷変化断面積()()()



平成10~12年度 低電離 Ni イオンの電荷変化断面積()()()



平成13~15年度 低電離 Fe イオンの電荷変化断面積()()()



平成16~19年度 低電離 W イオンの電荷変化断面積



文献調査 **データサーバ構築** (2006 年 10 月プロトタイプ稼働), **断面積測定** 国際会議・論文発表

- 今井誠 科学研究費補助金 基盤研究(C) 平成18~19年度
核融合プラズマ中の高Z不純物に関する**電荷変換断面積測定とデータサーバ構築**.
- **Makoto Imai**, Akio Itoh, Manabu Saito, Yoichi Haruyama and Hirotaka Kubo,
Production and compilation of charge changing cross sections of ion-atom and ion-molecule collisions,
The International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC XXV),
July 25 – 31, 2007, Freiburg, Germany.
- Makoto IMAI,
Electron Capture Cross Section for W⁺ Ion Colliding with Gaseous Targets & Compilation of Charge Changing Cross Section of Energetic Ion Collisions,
Core University Program Workshop, November 12 – 14, 2007, NFRI, Daejeon, Korea.
- M. V. Khoma, M. Imai, O. M. Karbovanets, Y. Kikuchi, M. Saito, Y. Haruyama, I. Yu. Kretinin, M. I. Karbovanets,
A. Itoh, R. J. Buenker,
A simple theoretical approach of electron capture processes in collisions of atomic ions with polar targets,
ready for submission. **Be²⁺ + CO, B²⁺ + CO, Be²⁺ + C₃H₈**

Electron Capture Cross Section for
W⁺ Ion Colliding with Gaseous Targets
Compilation of Charge Changing Cross Sections of
Energetic-Ion Collisions

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今井 誠



Core University Program Workshop,
NFRI, Daejeon, Nov 13, 2007

Outline

- Production (measurements) of charge changing (e-capture) cross sections of some fusion-related collision systems at Kyoto Univ.
Be^{1,2+}, B^{1,2+}, C^{1,2,3+}, Cr^{1,2+}, Fe⁺, Ni^{1,2+}, W⁺
+ He, Ne, Ar, Kr, H₂, CO, CO₂, N₂, CH₄, C₂H₆, C₃H₈
- Brief introduction to Japanese databases at JAEA and NIFS
- Compilation of experimental charge changing cross sections from literature (co-operative activity between JAEA and Kyoto Univ.)
 - Compilation since 1983
 - Electric version started in 2006
<http://toshi3.nucleng.kyoto-u.ac.jp:5560/isqlplus/>

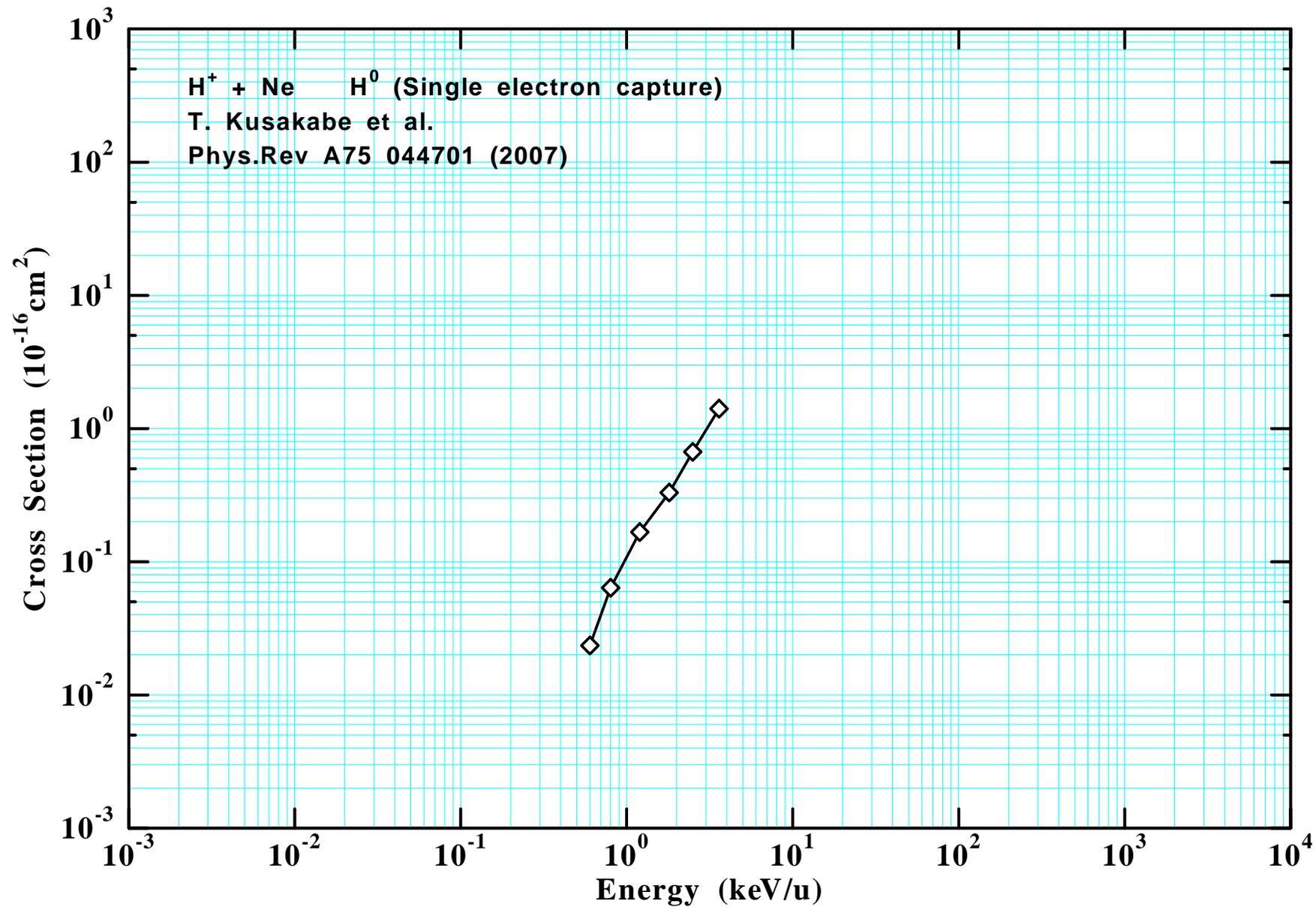
文献調査・データシート作成

抽出文献数

対象年	全断面積	部分断面積	その他	計
1983～1989	57			57
1990	16			16
1991	20			20
1992	12	12		24
1993	7	4		11
1994	10	8		18
1995	10	6	4	20
1996	7	2	2	11
1997	12	1	2	15
1998	5	6	1	12
1999	6	4	5	15
2000	6	1	3	10
2001	18	2	5	25
2002	2	2	7	11
2003	12	1	12	25
2004	12	1	8	21
2005	16	4	19	39
2006	5	2	11	18
2007	13	2	4	19
計	246	58	83	387

調査対象学術雑誌

- Atomic Data and Nuclear Data Tables
- The European Physical Journal D
- Europhysics Letters
- JETP
- JETP Letters
- Journal of Physical and Chemical Reference Data
- Journal of the Physical Society of Japan
- Journal of Physics B: Atomic, Molecular and Optical Physics
- Nuclear Instruments and Methods in Physics Research sect. A
- Nuclear Instruments and Methods in Physics Research sect. B
- Physica Scripta
- Physical Review A
- Physics Letters A



Charge Changing Collision Cross Section Database

Number of Collected Papers

Year	Total	Partial	Misc	Total
1983–1997	151	33	8	192
1998	5	6	1	12
1999	6	4	5	15
2000	6	1	3	10
2001	18	2	5	25
2002	3	2	6	11
2003	12	1	12	25
2004	12	1	8	21
2005	12	4	11	27
2006	5	2	11	18
Total	229	56	71	356

Journals under the survey

Atomic Data and Nuclear Data Tables
 The European Physical Journal D
 Europhysics Letters
 JETP
 JETP Letters
 Journal of Physical and Chemical Reference Data
 Journal of the Physical Society of Japan
Journal of Physics B: Atomic, Molecular and Optical Physics
 Nuclear Instruments and Methods in Physics Research sect. A
 Nuclear Instruments and Methods in Physics Research sect. B
 Physica Scripta
Physical Review A
 Physics Letters A

Electric Version:

<http://toshi3.nucleng.kyoto-u.ac.jp:5560/isqlplus/>

UserID: ICAMDATA

Password: MEUDON (Please do not change!!)

Now contains **1766 cross section data** for **486 collision systems** with **145 authors' information**, taken from **29 articles** published in **PRA** and **JPB** in **2004, 2005** and **2006**.

衝突断面積データサーバ

Charge Changing Collision Cross Section Database

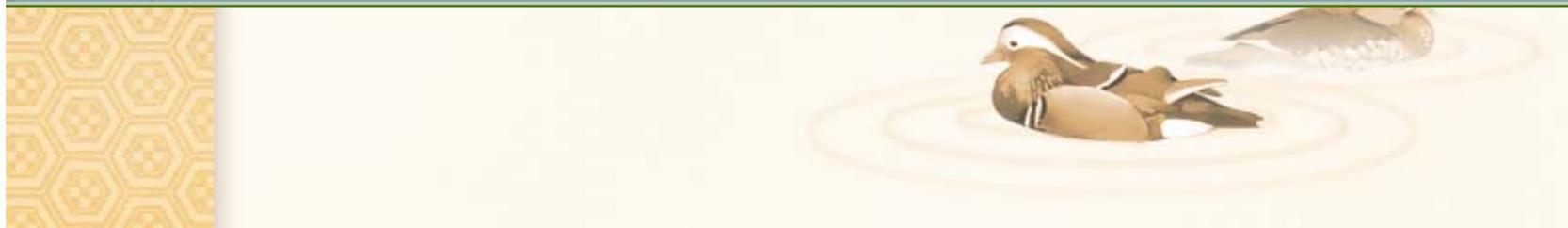
✳ Inside table "COL", including collision system information

DOCMO #	BRIND #	COLID #	PRCHG1 #	TW1F1 #	TAFDCHG #	PRLL1 #	PRLODCHG #	TW1F2 #	TW1GCHG #	PRCD #	EMM1 #	EMM2 #	TEMM1 #	TEMM2 #	PRIS #	PROCS #	PROCS #	PROCS #	PROCS #	METH #	FT #			
280400	11	01	01	01	01	01	01	01	01		2290	41800	81300	113000	01	01					ATT NORM	T		
280400	10	01	01	01	01	01	01	01	01		2290	12300	81300	113000	01	01						ATT NORM	T	
280400	4	01	01	01	01	01	01	01	01	2	26	03920	89920	899000	899000	01	01					ID PRC NORM	T	
280400	8	01	01	01	01	01	01	01	01	2	46	03920	89920	899000	899000	01	01					ID PRC NORM	T	
280400	3	01	01	01	01	01	01	01	01	1	26	03920	89920	899000	899000	01	01					ID PRC NORM	T	
280400	2	01	01	01	01	01	01	01	01	2	26	03920	89920	899000	899000	01	01					ID PRC NORM	T	
280400	7	01	01	01	01	01	01	01	01	1	6	03920	89920	899000	899000	01	01					ID PRC NORM	T	
280400	3	01	01	01	01	01	01	01	01		2670	52800	41700	818000	01	01							ATT NORM	T
280400	2	01	01	01	01	01	01	01	01		2670	49800	41700	825000	01	01							ATT NORM	T
280400	1	01	01	01	01	01	01	01	01		2670	49800	41700	825000	01	01							ATT NORM	T
280400	5	01	01	01	01	01	01	01	01	2	26	03920	89920	899000	899000	01	01					ID PRC NORM	T	
1	90	01	01	01	01	01	01	01	01		1810	1810	20000	30000	01	01							01	F
1	94	01	01	01	01	01	01	01	01		1384	1810	18000	30000	01	01							01	F
1	93	01	01	01	01	01	01	01	01		1810	1810	20000	30000	01	01							01	F
1	92	01	01	01	01	01	01	01	01	At	1384	1810	18000	30000	01	01							01	F
1	91	01	01	01	01	01	01	01	01	Ne	1384	1810	18000	30000	01	01							01	F
1	89	01	01	01	01	01	01	01	01		1810	1810	20000	30000	01	01							01	F
1	88	01	01	01	01	01	01	01	01		1384	1810	18000	30000	01	01							01	F
1	87	01	01	01	01	01	01	01	01	At	1384	1810	18000	30000	01	01							01	F
1	85	01	01	01	01	01	01	01	01	Ne	1384	1810	18000	30000	01	01							01	F
1	83	01	01	01	01	01	01	01	01		1810	1810	20000	30000	01	01							01	F
1	82	01	01	01	01	01	01	01	01	At	1384	1810	18000	30000	01	01							01	F
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1	35	01	01	01	01	01	01	01	01		455	1384	5000	15000	01	01							01	F
1	33	01	01	01	01	01	01	01	01	Ne	883	1384	7000	15000	01	01							01	F
1	32	01	01	01	01	01	01	01	01	At	486	1384	8000	15000	01	01							01	F
1	31	01	01	01	01	01	01	01	01	Ne	486	1384	8000	15000	01	01							01	F
1	28	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	27	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	26	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	25	01	01	01	01	01	01	01	01		2887	2500	24000	12000	01	01							01	F
1	24	01	01	01	01	01	01	01	01	At	1887	2223	18000	30000	01	01							01	F
1	23	01	01	01	01	01	01	01	01	At	1887	2223	18000	30000	01	01							01	F
1	22	01	01	01	01	01	01	01	01	Ne	1887	2223	18000	30000	01	01							01	F
1	21	01	01	01	01	01	01	01	01	Ne	1887	2223	18000	30000	01	01							01	F
1	18	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	17	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	16	01	01	01	01	01	01	01	01		1770	3880	18000	11000	01	01							01	F
1	15	01	01	01	01	01	01	01	01		1887	2223	18000	11000	01	01							01	F

Charge Changing Collision Cross Section Database

Inside table "DOC", including document information

DOCNO #	REF #	VOL #	NO #	PAGE #	PAGE# #	YEAR #	MONTH #	TITLE	A	AUTH1 #	AUTH2 #	AUT
1	JPR9	7		322	318	2006		Production and Comparison of Charge Changing Cross Sections of Ion-Atom and Ion-Molecule Collisions		Mima	T. Shirai	M E
2064001	JPR	37	2	403	413	2004	January	Electron transfer and decay processes of highly charged sodium ions		H. Sakai	A. Camp	KH
2064002	JPR	37	23	4578	4583	2004	November	Projectile electron loss and capture in MeV/u collisions of Urap 284 with Hsub 2, Hsub 3 and Ar		RC. Olson	RL. Watson	VA
2064003	PRK	68	1	812703	9	2004	January	Absolute electron detachment cross sections of atomic anions of the second and third periods incident on noble gases		F. Zappa	G. Jabari	LF3
2064004	PRK	68	5	852704	7	2004	May	Electron capture by HeIsub 3+ ions from atomic hydrogen		R. Rejzab	MC. Barstler	CC
2064005	PRK	68	5	852715	6	2004	May	Single- and double-electron-capture collisions of Ctrap qv (q = 3, 4) with CO at keV energies		H. Guo	W-S. Kwong	
2064006	PRK	78	2	822706	8	2004	August	Double- and single-electron transfer in HeIsub 4+ K collisions from E.3 to 4keV. Separation of direct double transfer and two-step successive single-electron transfer		E. Hasekawa	K. Kadosaka	MI
2064007	PRK	78	3	832712	7	2004	September	Electron loss from 1-4 MeV/u Urap 4, 6, 18+ ions colliding with He, Hsub 2, and Ar targets		RD. DuBois	ACF. Santos	Th
2064008	PRK	78	3	834701	7	2004	September	Ionization of helium by impact of negative B, O, and F ions		F. Zappa	ALF. Barros	LF3
2064009	PRK	78	4	842701	9	2004	October	Electron capture and loss by kilo-electron-volt oxygen atoms in collisions with He, Hsub 2, Hsub 3, and CHap 3+		BO. Lindsay	WS. Ya	RF
2064010	PRK	78	4	842716	14	2004	October	Electron-capture cross sections of multiple charged slowsters of carbon, nitrogen, and oxygen in He		K. Yuki	A. Ishi	KO
2064011	PRK	78	5	852716	7	2004	November	Isotope effect in charge-transfer collisions of slow Hsub 4+ and Dsub 4+ ions with Hsub 2, HD, and Dsub 2 molecules		T. Kasakabe	L. Pehl	RJ
2064012	PRK	78	6	862716	8	2004	December	Ionization of water by 120-1500-keV protons: Separation of direct-ionization and electron-capture processes		F. Sobel	S. Eden	BC
2065001	JPR	38	13	1977	1985	2005	June	Electron transfer in collisions of keV hydrogen atoms and ions with methane		BO. Lindsay	WS. Ya	RF
2065002	PRK	71	2	822705	7	2005	February	Charge exchange and dissociative processes in collisions of slow HeIsub 2+ ions with Hsub 2O molecules		B. Sedyrak	RW. McCallough	HT
2065003	PRK	71	2	822713	5	2005	February	Collision mechanisms in one-electron capture by HeIsub 2+ ions in collisions with hydrocarbons		B. Sedyrak	RW. McCallough	HS
2065004	PRK	71	3	832705	9	2005	March	Cross sections for charge-changing processes involving kilo-electron-volt H and Hsub 4+ with CO and COsub 2		BO. Lindsay	WS. Ya	RF
2065005	PRK	71	3	834702	4	2005	March	Electron capture in HeIsub 4+ ions from atomic hydrogen		CC. Haines	R. Rejzab	CR
2065006	PRK	71	4	842707	9	2005	April	Charge transfer in low-energy collisions of HeIsub 2+ with atomic hydrogen		CC. Haines	R. Rejzab	PS
2065007	PRK	72	1	812707	8	2005	July	Charge state-resolved cross sections for electron loss, capture, and ionization in CHap 3+He collisions		T. Kocner	ACF. Santos	H L
2065008	PRK	72	1	812713	7	2005	July	Reaction molecular distributions for transfer ionization in fast proton He collisions		HT. Schmidt	J. Janson	PR
2065009	PRK	72	3	832707	7	2005	September	Ionization cross sections of small cationic carbon clusters in high-energy collisions with helium atoms and stability of multiple charged species		F. Meiboe	K. Yuki	BC
2065010	PRK	72	3	832708	5	2005	September	Hsub 2 and Hsub 3 ionization and dissociative ionization by CHap 4+ and CHap 4+ ions at intermediate velocities: Direct and electron loss channels		ALF. Barros	S. Matczak	F Z
2065011	PRK	72	4	842701	7	2005	October	Single-electron capture processes in slow collisions of HeIsub 2+ ions with CHap 2, Hsub 3, Hsub 3, and COsub 2		O. Abel-Sala	E. Kamber	SM
2065012	PRK	72	5	852716	7	2005	November	Charge-changing cross sections of HeIsub 0,1+ and HeIsub 0,1+3+ projectiles in CHap 6+		A. Ishi	K. Nose	YH



Charge Changing Collision Cross Section Database

- Select docno, sysno from ALEX.COL
where proj1 like 'U' and targ1 like 'Ar';

作業領域

SQL: F1/F5/F6/F7/F8/F9/F10/F11/F12/F13/F14/F15/F16/F17/F18/F19/F20/F21/F22/F23/F24/F25/F26/F27/F28/F29/F30/F31/F32/F33/F34/F35/F36/F37/F38/F39/F40/F41/F42/F43/F44/F45/F46/F47/F48/F49/F50/F51/F52/F53/F54/F55/F56/F57/F58/F59/F60/F61/F62/F63/F64/F65/F66/F67/F68/F69/F70/F71/F72/F73/F74/F75/F76/F77/F78/F79/F80/F81/F82/F83/F84/F85/F86/F87/F88/F89/F90/F91/F92/F93/F94/F95/F96/F97/F98/F99/F100/F101/F102/F103/F104/F105/F106/F107/F108/F109/F110/F111/F112/F113/F114/F115/F116/F117/F118/F119/F120/F121/F122/F123/F124/F125/F126/F127/F128/F129/F130/F131/F132/F133/F134/F135/F136/F137/F138/F139/F140/F141/F142/F143/F144/F145/F146/F147/F148/F149/F150/F151/F152/F153/F154/F155/F156/F157/F158/F159/F160/F161/F162/F163/F164/F165/F166/F167/F168/F169/F170/F171/F172/F173/F174/F175/F176/F177/F178/F179/F180/F181/F182/F183/F184/F185/F186/F187/F188/F189/F190/F191/F192/F193/F194/F195/F196/F197/F198/F199/F200/F201/F202/F203/F204/F205/F206/F207/F208/F209/F210/F211/F212/F213/F214/F215/F216/F217/F218/F219/F220/F221/F222/F223/F224/F225/F226/F227/F228/F229/F230/F231/F232/F233/F234/F235/F236/F237/F238/F239/F240/F241/F242/F243/F244/F245/F246/F247/F248/F249/F250/F251/F252/F253/F254/F255/F256/F257/F258/F259/F260/F261/F262/F263/F264/F265/F266/F267/F268/F269/F270/F271/F272/F273/F274/F275/F276/F277/F278/F279/F280/F281/F282/F283/F284/F285/F286/F287/F288/F289/F290/F291/F292/F293/F294/F295/F296/F297/F298/F299/F300/F301/F302/F303/F304/F305/F306/F307/F308/F309/F310/F311/F312/F313/F314/F315/F316/F317/F318/F319/F320/F321/F322/F323/F324/F325/F326/F327/F328/F329/F330/F331/F332/F333/F334/F335/F336/F337/F338/F339/F340/F341/F342/F343/F344/F345/F346/F347/F348/F349/F350/F351/F352/F353/F354/F355/F356/F357/F358/F359/F360/F361/F362/F363/F364/F365/F366/F367/F368/F369/F370/F371/F372/F373/F374/F375/F376/F377/F378/F379/F380/F381/F382/F383/F384/F385/F386/F387/F388/F389/F390/F391/F392/F393/F394/F395/F396/F397/F398/F399/F400/F401/F402/F403/F404/F405/F406/F407/F408/F409/F410/F411/F412/F413/F414/F415/F416/F417/F418/F419/F420/F421/F422/F423/F424/F425/F426/F427/F428/F429/F430/F431/F432/F433/F434/F435/F436/F437/F438/F439/F440/F441/F442/F443/F444/F445/F446/F447/F448/F449/F450/F451/F452/F453/F454/F455/F456/F457/F458/F459/F460/F461/F462/F463/F464/F465/F466/F467/F468/F469/F470/F471/F472/F473/F474/F475/F476/F477/F478/F479/F480/F481/F482/F483/F484/F485/F486/F487/F488/F489/F490/F491/F492/F493/F494/F495/F496/F497/F498/F499/F500/F501/F502/F503/F504/F505/F506/F507/F508/F509/F510/F511/F512/F513/F514/F515/F516/F517/F518/F519/F520/F521/F522/F523/F524/F525/F526/F527/F528/F529/F530/F531/F532/F533/F534/F535/F536/F537/F538/F539/F540/F541/F542/F543/F544/F545/F546/F547/F548/F549/F550/F551/F552/F553/F554/F555/F556/F557/F558/F559/F560/F561/F562/F563/F564/F565/F566/F567/F568/F569/F570/F571/F572/F573/F574/F575/F576/F577/F578/F579/F580/F581/F582/F583/F584/F585/F586/F587/F588/F589/F590/F591/F592/F593/F594/F595/F596/F597/F598/F599/F600/F601/F602/F603/F604/F605/F606/F607/F608/F609/F610/F611/F612/F613/F614/F615/F616/F617/F618/F619/F620/F621/F622/F623/F624/F625/F626/F627/F628/F629/F630/F631/F632/F633/F634/F635/F636/F637/F638/F639/F640/F641/F642/F643/F644/F645/F646/F647/F648/F649/F650/F651/F652/F653/F654/F655/F656/F657/F658/F659/F660/F661/F662/F663/F664/F665/F666/F667/F668/F669/F670/F671/F672/F673/F674/F675/F676/F677/F678/F679/F680/F681/F682/F683/F684/F685/F686/F687/F688/F689/F690/F691/F692/F693/F694/F695/F696/F697/F698/F699/F700/F701/F702/F703/F704/F705/F706/F707/F708/F709/F710/F711/F712/F713/F714/F715/F716/F717/F718/F719/F720/F721/F722/F723/F724/F725/F726/F727/F728/F729/F730/F731/F732/F733/F734/F735/F736/F737/F738/F739/F740/F741/F742/F743/F744/F745/F746/F747/F748/F749/F750/F751/F752/F753/F754/F755/F756/F757/F758/F759/F760/F761/F762/F763/F764/F765/F766/F767/F768/F769/F770/F771/F772/F773/F774/F775/F776/F777/F778/F779/F780/F781/F782/F783/F784/F785/F786/F787/F788/F789/F790/F791/F792/F793/F794/F795/F796/F797/F798/F799/F800/F801/F802/F803/F804/F805/F806/F807/F808/F809/F810/F811/F812/F813/F814/F815/F816/F817/F818/F819/F820/F821/F822/F823/F824/F825/F826/F827/F828/F829/F830/F831/F832/F833/F834/F835/F836/F837/F838/F839/F840/F841/F842/F843/F844/F845/F846/F847/F848/F849/F850/F851/F852/F853/F854/F855/F856/F857/F858/F859/F860/F861/F862/F863/F864/F865/F866/F867/F868/F869/F870/F871/F872/F873/F874/F875/F876/F877/F878/F879/F880/F881/F882/F883/F884/F885/F886/F887/F888/F889/F890/F891/F892/F893/F894/F895/F896/F897/F898/F899/F900/F901/F902/F903/F904/F905/F906/F907/F908/F909/F910/F911/F912/F913/F914/F915/F916/F917/F918/F919/F920/F921/F922/F923/F924/F925/F926/F927/F928/F929/F930/F931/F932/F933/F934/F935/F936/F937/F938/F939/F940/F941/F942/F943/F944/F945/F946/F947/F948/F949/F950/F951/F952/F953/F954/F955/F956/F957/F958/F959/F960/F961/F962/F963/F964/F965/F966/F967/F968/F969/F970/F971/F972/F973/F974/F975/F976/F977/F978/F979/F980/F981/F982/F983/F984/F985/F986/F987/F988/F989/F990/F991/F992/F993/F994/F995/F996/F997/F998/F999/1000

```

select docno, sysno from ALEX.COL
where proj1 like 'U' and targ1 like 'Ar';
select * from ALEX.COL where docno=00000001;
select * from ALEX.COL where docno=00000002 and sysno=01;
select * from ALEX.COL where docno=00000002 and sysno=02;
    
```

DOCNO	SYSNO	
200000		41
200000		42
200000		43
200000		44
200000		45
200000		46
200000		47
200000		48
200000		49
200000		50
200000		51
200000		52
200000		53
200000		54
200000		55
200000		56
200000		57
200007		11
200007		12
200007		13
200007		14
200007		15
200007		16
200007		17

Charge Changing Collision Cross Section Database

Select * from ALEX.COL where docno=2004002 and sysno=41;

The screenshot shows the Oracle iSQL*Plus web interface. The browser address bar displays the URL: `http://booth.nucleing.kyoto-u.ac.jp:5580/iSQL*Plus/Workspace.us?event=execPage`. The page title is "ORACLE iSQL*Plus". The user is logged in as "BOAMDATA@boam".

The "作業領域" (Work Area) section contains the following SQL query:

```
SQL, PL/SQLおよびSQL*Plus文を入力してください
select docno, sysno from ALEX.COL
  where proj1 like 'U' and targ1 like 'Ar';
select * from ALEX.DOC where docno=2004002;
select * from ALEX.COL where docno=2004002 and sysno=41;
select * from ALEX.DATA where docno=2004002 and sysno=41;
```

Below the query, there are buttons for "実行" (Execute), "スクリプトのロード" (Load Script), "スクリプトの保存" (Save Script), and "取消" (Cancel).

The results are displayed in a table with the following columns: DOCNO, SYSNO, PROJ1, PROJ1CHG, TARG1, TARG1CHG, PROJ2, PROJ2CHG, TARG2, TARG2CHG, PROD, EMIN, EMAX, TMIN, TMAX, PROC, PROC2, PROC3, PROC4, PROC5, METH, F.

DOCNO	SYSNO	PROJ1	PROJ1CHG	TARG1	TARG1CHG	PROJ2	PROJ2CHG	TARG2	TARG2CHG	PROD	EMIN	EMAX	TMIN	TMAX	PROC	PROC2	PROC3	PROC4	PROC5	METH	F
2004002	41	U		20	Ar	0	U	27	Ar		3500000	6500000	833000000	1550000000	SC					GR	T

At the bottom right, there is a button labeled "次のページ" (Next Page).

Charge Changing Collision Cross Section Database

- Select * from ALEX.DATA where docno=2004002 and sysno=41;



The screenshot shows the iSQL*Plus web interface in a Mozilla Firefox browser. The browser address bar shows the URL: `http://toshi@nuclenak.yoto-u.ac.jp:5560/izsqlplus/workspace/iz?event=nextPage`. The page header includes the Oracle iSQL*Plus logo and navigation links for login, change password, and help. The user is logged in as 'IDAMDATA@nasa'. The main area is titled '作業領域' (Work Area) and contains a text input field with the following SQL query:

```
select docno, sysno from ALEX.COL
  where proj1 like 'U' and targ1 like 'Ar';
select * from ALEX.DOC where docno=2004002;
select * from ALEX.COL where docno=2004002 and sysno=41;
select * from ALEX.DATA where docno=2004002 and sysno=41;
```

Below the query input are buttons for '実行' (Execute), 'スクリプトのロード' (Load Script), 'スクリプトの保存' (Save Script), and '取消' (Cancel). The results are displayed in a table with the following data:

DOCNO	SYSNO	E	TE	CS	EERR	TEERR	CSERR
2004002	41	3600000	833000000	1.1200E-17			8.9000E-19
2004002	41	6600000	1560000000	3.9000E-19			9.0000E-20

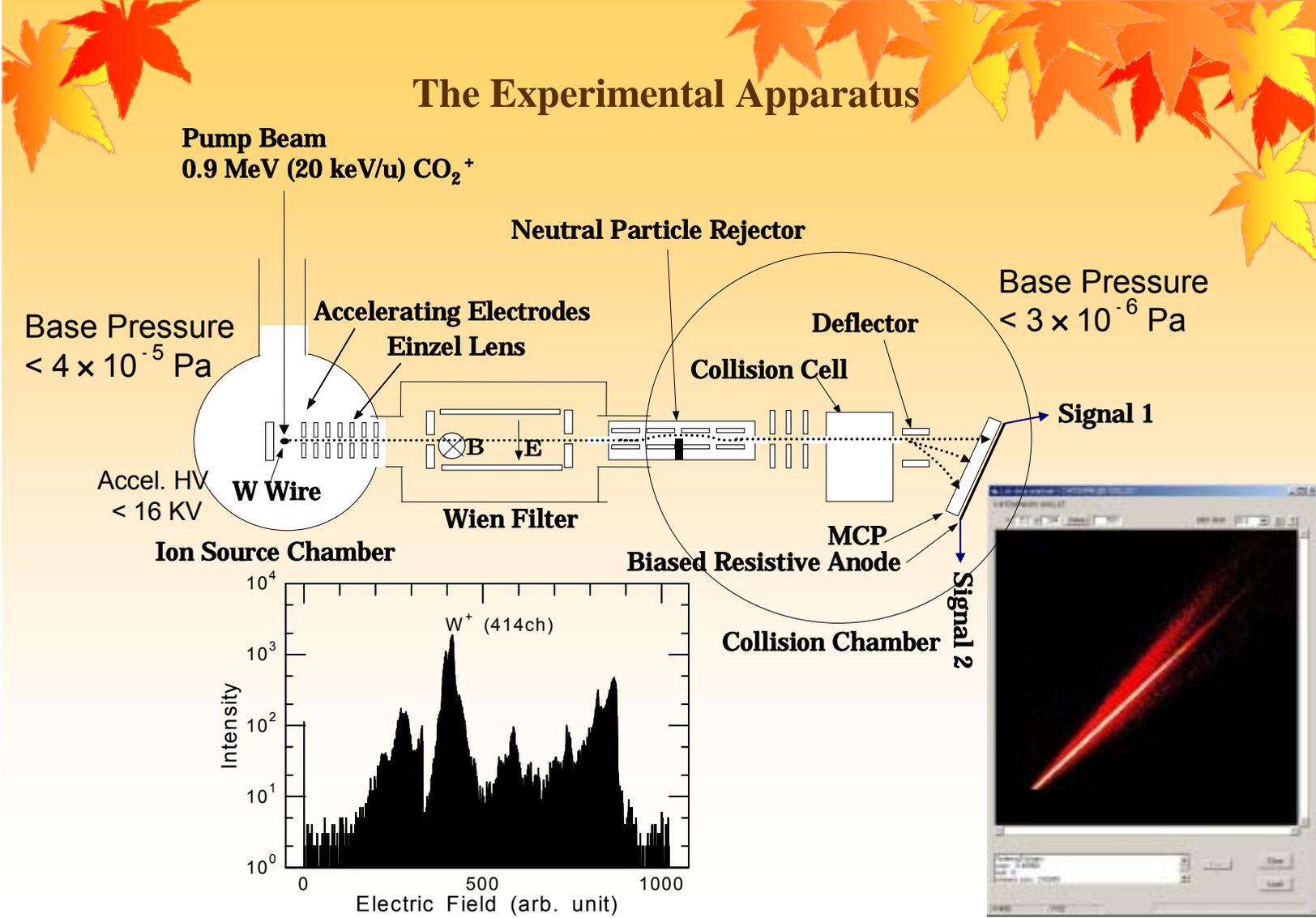
Charge Changing Collision Cross Section Database

Plan for 2008

- Retroactive input of data for previous period and other journals
- **Joining IAEA Genie Network**

2008 年中に今井が渡嶼して作業することを同意済み

The screenshot shows the GENIE website interface. The main heading is "GENIE A General Internet Search Engine for Atomic Data". The page is divided into several sections: "Transition Probabilities Wavelengths Energy Levels" with a search input field; a central "Genie" logo; and "Electron Impact Cross Sections and/or Rate Coefficients" with a "Test #" field and a "Select the process" section. The "Select the process" section lists several databases with checkboxes: IAEA ALADDI Database, IAEA AMDIS Database, CAMSD Collision Program, and IAEA Atomic Cross Sections. At the bottom, there are links for "Contacts", "ALADDI", "AMDIS", "A+M Data Unit", and "IAEA".



How to Derive Cross Sections

Rate equation for W^{i+} intensity

$$\frac{dF_i(\pi)}{d\pi} = \sum_{j \neq i} [F_j(\pi)\sigma_{ji} - F_i(\pi)\sigma_{ij}],$$

$$\sum_i F_i(\pi) = 1,$$

where

$F_i(\pi)$: Relative Intensity of W^{i+} ion

π : Target Thickness (= Density \times Length in /cm²)

σ_{ji} : Charge Transfer Cross Section (cm²) $W^{j+} \rightarrow W^{i+}$

Under the Single Collision Condition, this simultaneous equation

reduces to

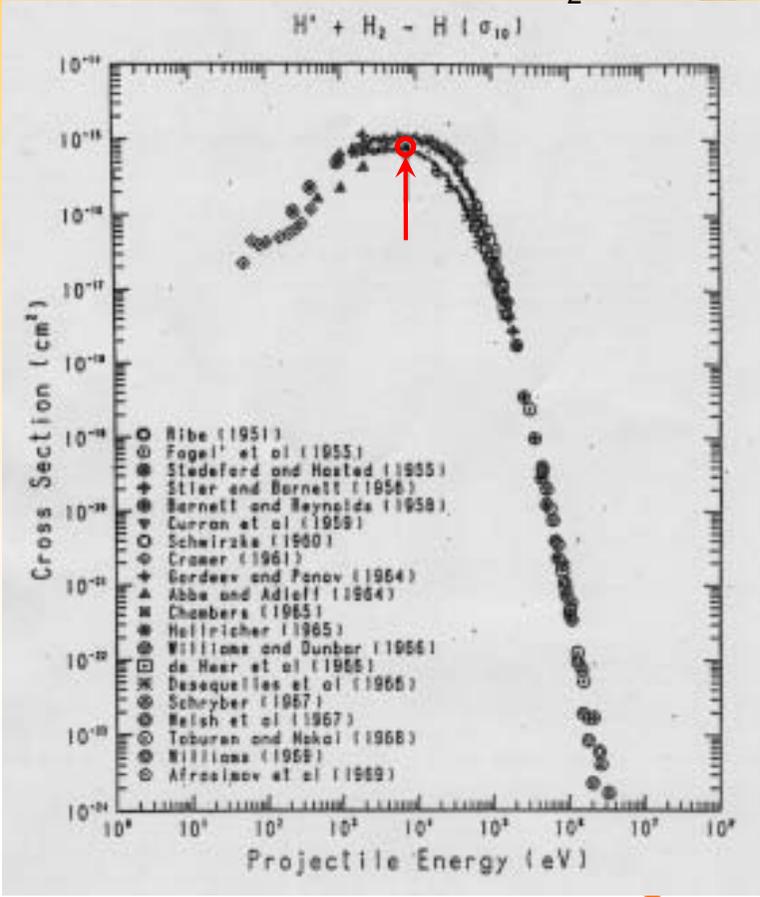
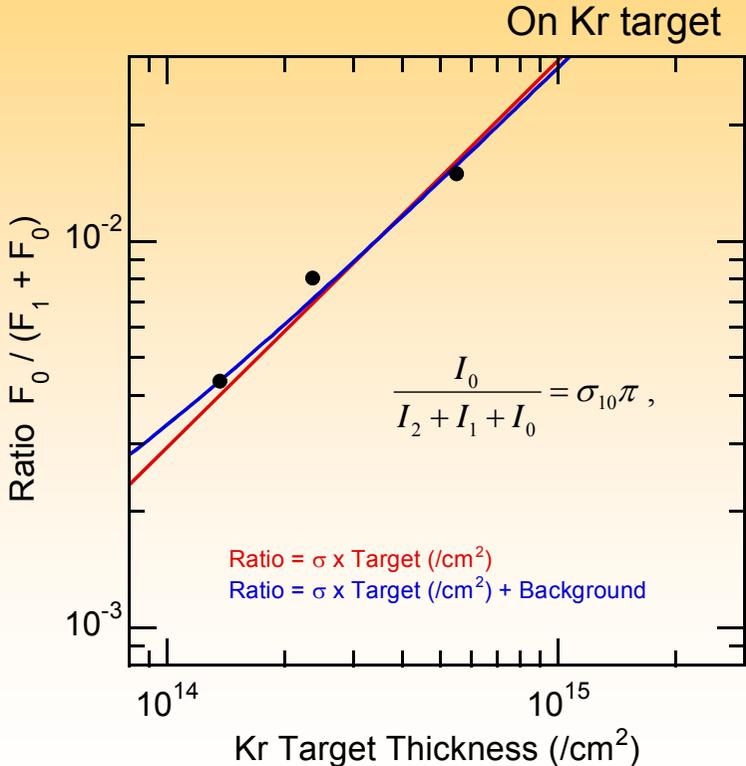
$$\frac{I_0}{I_2 + I_1 + I_0} = \sigma_{10}\pi, \quad \frac{I_2}{I_2 + I_1 + I_0} = \sigma_{12}\pi,$$

where

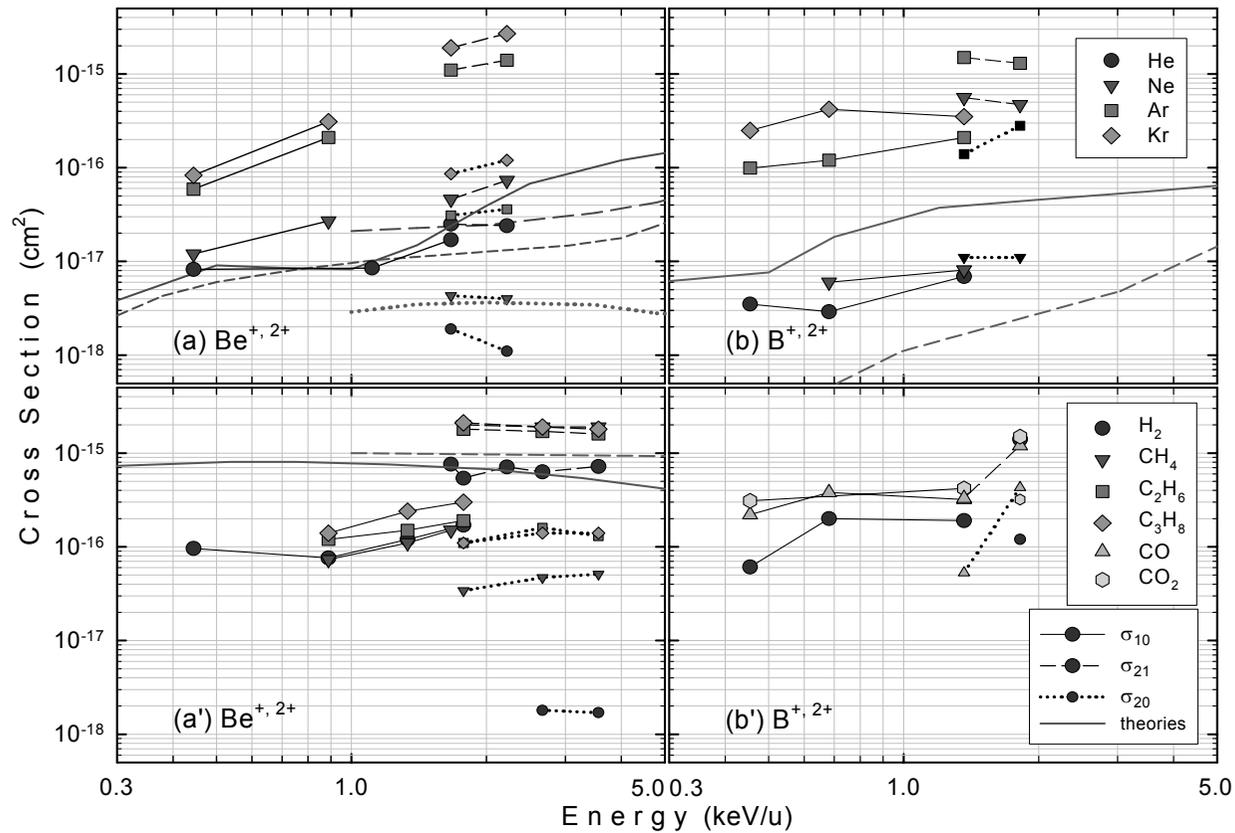
I_2, I_1, I_0 : Intensity of W^{2+}, W^{+} and W^0 , respectively.

Data Processing

Bench mark for 7.5 keV H⁺ + H₂ collision



測定結果



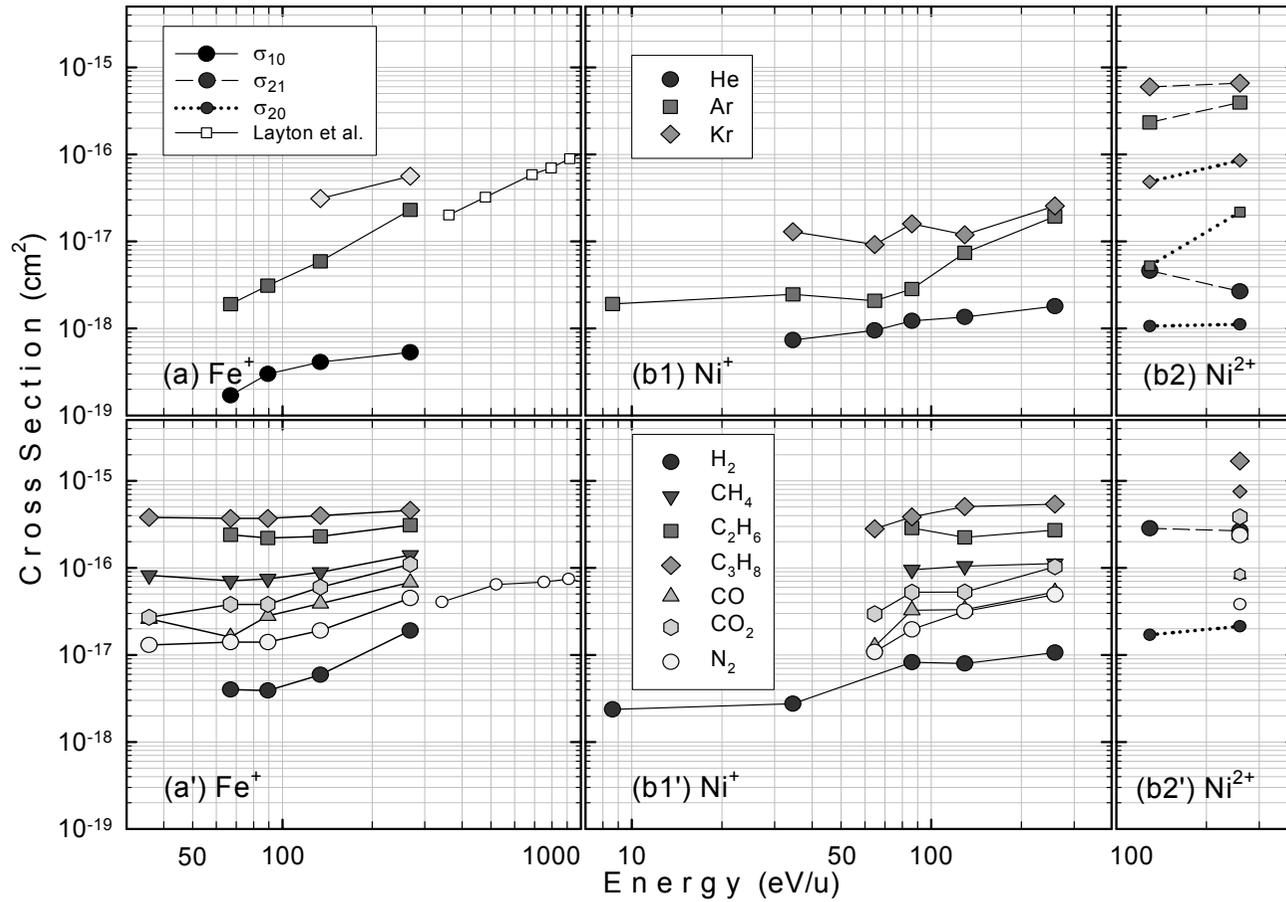
Single and double electron capture cross sections σ_{10} , σ_{21} and σ_{20} for (a), (a') Be ions and (b), (b') B ions.

Present value: filled symbols connected with full and dashed lines, σ_{10} and σ_{21} , respectively; filled smaller symbols connected with dotted lines, σ_{20} .

Calculated values: (a) open circle with full line, σ_{10} for He by Shimakura; open circle and triangle with dashed line, σ_{21} for He by Fritsch and Suzuki et al., respectively; open circle with dotted line, σ_{20} for He by Fritsch; (a') open circle and triangle with dashed line, σ_{21} for H₂ by Kimura and Lane and Schultz et al., respectively; (b) open circle and triangle with full line, σ_{10} for He by Shimakura et al. and Hansen and Dubois, respectively.

ICAMDATA2004 (October 5–8, 2004, 土岐市); Journal of Plasma and Fusion Research SERIES Vol.7 (2006), pp.323–326.

測定結果



Single and double electron capture cross sections σ_{10} , σ_{21} and σ_{20} for (a), (a') Fe^+ ion, (b1), (b1') Ni^+ ion and (b2), (b2') Ni^{2+} ion. Present value: filled symbols connected with full and dashed lines, σ_{10} and σ_{21} , respectively; filled smaller symbols connected with dotted lines, σ_{20} . Open square and circle with full line in the (a) and (a') sections denote experimental values σ_{10} for Ar and N_2 targets, respectively, by Layton et al.

ICAMDATA2004 (October 5–8, 2004, 土岐市); Journal of Plasma and Fusion Research SERIES Vol.7 (2006), pp.323–326.

測定結果

