I. SPECTRAL LINE SHAPES INVESTIGATIONS IN YUGOSLAVIA AND SERBIA 1997-2000

Four previously published Bibliographies with Citation Index on Spectral Line Shapes Investigations in Yugoslavia, cover the period 1962 - 1997 (Dimitrijević, 1990, 1991, 1994, 1997). From March of 1997 up to the 31 December 2000, 298 articles concerning line shapes investigations have been published by Yugoslav (Serbian) authors. In Serbia defended have been defended also 3 Ph. D. and 3 M. Sc. Theses. Accordingly, since the first article on this topic (Vujnović et al., 1962) up to the 31 December 2000, 1427 (1222 by Serbian authors) bibliographic items have been published by 179 Yugoslav authors (152 from Serbia, 26 from Croatia and 1 living in France).

In the considered period various problems have been investigated and several review papers and progress reports have been published (1128, 1129, 1131, 1133, 1137, 1139, 1166, 1167, 1290-1292, 1319-1321, 1334, 1335, 1356-1358, 1380, 1381). Stark broadening of hydrogen and hydrogen-like emitter lines, has been studied in particular for H beta line. Its profile assymetry (1347, 1407-1410), shifts of central parts (1194, 1270), theoretical Stark broadened profile (1379, 1385), line shape in coaxial diode discharge (1196), the influence of the fine structure to line shape in a glow discharge cathode fall region (1278), the application of line shape for electron density diagnostics in the range 10^{20}-10^{21} m^{-3} (1317) and the effect of magnetic field on its emission from a T-tube plasma (1130, 1161) have been considered. Also, a paper is devoted to the program for electron density determination from the experimental H beta line profile (1427). The influence of the fine structure to the Stark splitting of the H gamma line in an external electric field (1279), characteristic line profile parameters of hydrogen Balmer lines in such a field (1351), and the use of atomic hydrogen line shapes for the excited hydrogen atoms temperature determination in a glow discharge (1197) have been considered as well. Stark broadening of He II Paschen alpha line shapes has been considered in Refs. 1412 and 1426.

Work on the experimental determination of Stark broadening parameters of nonhydrogenic atom and ion spectral lines has been continued during the considered period: Stark broadening of following atoms and ions has been investigated: Ar I (1175, 1243, 1248-1250, 1252, 1322, 1328, 1329, 1331, 1386, 1395), Ar II (1315, 1326, 1327, 1332, 1395), Ar III (1315), Ar IV (1313), B II (1205), C II (1202, 1283, 1284, 1374, 1415, 1416), C III (1202, 1205, 1284, 1355, 1374, 1415), C IV (1308, 1374, 1413, 1415), F II (1283), F III (1355), He I (1386), Kr I (1386), Kr II (1388, 1389, 1391), Kr III (1390, 1391), N II (1174, 1202, 1204, 1205, 1244, 1246, 1247, 1283, 1284), N III (1202, 1237, 1244, 1284, 1355), N IV (1244), N V (1245), Ne I (1386), Ne II (1370, 1371, 1283), Ne III (1355), Ne IV (1387), O II (1173, 1202, 1238, 1283, 1284, 1324, 1414), O III (1202, 1205, 1284, 1355), O V (1245), O VI (1312), S IV (1376), Si I (1195, 1271). Moreover, ion broadening parameters have been determined for Ar I (1251, 1396, 1398) and C I (1332, 1397, 1398). Also, the influence of ion dynamics (1171), temperature dependence (1160, 1161, 1325), departure from LS coupling (1203) and Li-, Be-, B- and C-isoelectronic sequences (1282, 1285, 1289, 1353, 1354) have been investigated, as well as the use of relative intensities of forbidden and allowed components of He I lines for electric field measurements (1169, 1172, 1242) and the use of non hydrogenic spectral

line shapes for the electron density diagnostics of inductively coupled plasmas (1167, 1168), fitting procedures for recovering the profile of spectral lines (1384) and deconvolution procedure (1253, 1254, 1333, 1378)

Using the semiclassical perturbation approach (Sahal-Bréchot, 1969a,b), the spectra of the following elements have been investigated: Zn I (1298, 1300, 1302), Ca I (1293, 1299, 1304, 1362), Au I (1341, 1342), Sr I (1156), Mg II (1218), Tl III (1224, 1229, 1304), In III (1229, 1304), Y III (1143, 1144, 1150, 1233), Ne IV (1387), Pb IV (1224, 1229, 1304), P IV (1152, 1157), V V (1145, 1148, 1209), S V (1142, 1146, 1208), F VI (1226, 1228, 1235), Cl VII (1226, 1228, 1235), O VII (1147, 1214, 1222), Ar VIII (1301), K VIII (1223, 1230, 1231), Kr VIII (1296, 1297), K IX (1230, 1231, 1234), Ca IX (1155, 1216), Ca X (1151, 1155, 1216), Na X (1212, 1215, 1221), Sc X (1210, 1213, 1220), Mg XI (1211, 1214, 1222), Si XI (1153, 1154, 1217), Ti XI (1213, 1219, 1220, 1225), Sc XI (1220, 1227), Ti XII (1213, 1219, 1220, 1232), Si XIII (1149, 1154, 1217) and V XIII (1148, 1209).

When it is not possible to use the semiclassical perturbation approach with the appropriate accuracy due to the lack of reliable atomic data, the modified semiempirical method (Dimitrijević and Konjević, 1980) has been used. This method has been reviewed in Refs. (1182, 1359) and applied to the lines of Ag II (1424), Au II (1265, 1341, 1342, 1422, 1423), Bi III (1141, 1207), Co II (1350, 1422, 1423), Co III (1423), Cu III (1181, 1189), Eu II (1339, 1340, 1256, 1260), Eu III (1339, 1340), Ga III (1183, 1188), 1259), Kr II (1258, 1388, 1389, 1391, 1402), Kr III (1390, 1391), La II, La III (1185, 1187, 1339, 1340), Mn II (1180, 1188, 1259), Na II (1186), Nd II (1411), Pd II (1421), Ra II (1349), Sc II (1179), Sn II (1383), Sr III (1184, 1257), Ti II (1275), 1422, 1423), Ti III (1276), Tl II (1392), V II (1261, 1262, 1401), V III (1262, 1401), V IV (1262, 1401), Xe II, Y II (1179), Zr II (1179, 1404) and Zr III (1333, 1404).

A special attention has been paid in a number of papers to the investigation of regularities and systematic trends of Stark broadening parameters (1158, 1159, 1191. 1193, 1236, 1239, 1240, 1268, 1269, 1272, 1273, 1308-1312, 1315, 1345, 1346, 1366, 1368, 1369, 1387, 1406, 1419). Similarities of Stark broadening parameters within supermultiplet (1158, 1159, 1236) have been investigated as well as Stark parameters dependence on the emitter rest core charge (seeing by optical electron) within a transition array (1419), ion off-resonances (1191) and isoelectronic sequences (1269, 1345), Stark width regularities along the argon isonuclear sequence (1240) and within Ar II spectrum (1272, 1273). By using regularities and systematic trends, Stark broadening parameters of a number of ion lines have been predicted (1193, 1239, 1308, 1312, 1367-1369).

Astronomical aspects of spectral line shapes were studied in a number of publications, as Balmer emission in Solar and AGN coronas (1200, 1201, 1418), white dwarfs (1165) and stellar flares (1377), modeling of double-peaked lines in AGN, Sy I and quasar spectra (1263, 1343, 1403, 1405), line profiles variation in Mrk 817 (1177, 1190), spectral line investigation of active galactic nuclei (1255, 1334, 1335, 1417), Lyman alpha forest and the total absorption cross-section of galaxies (1346), QSO environment and associated damped Ly alpha galaxies (1348), diffuse bands in interstellar spectra and

fullerenes (1138), contribution of interstellar matter to linewidths of Ca II lines in spectra of late type stars (1163), line profile variability of non-radially pulsating Be stars (1164), zirconium conflict in abundance determination (1337, 1361, 1404), Stark broadening mechanism in stellar atmospheres (1264, 1394), the chromospheric behaviour of photospheric Mn I 539.47 nm spectral lines (1133), spectroscopic investigations during Solar eclipses (1352), the influence of Belgrade Solar Spectrograph's apparatus function on line profiles (1199) and solution of the non LTE transfer problem using the method of iteration factors (1132). The work on the formation of a Data Base BELDATA for the Stark broadening parameters and galaxies with Active Galactic Nuclei (AGN) spectra is also underway (1338, 1359, 1393).

ISTRAŽIVANJA OBLIKA SPEKTRALNIH LINIJA U JUGOSLAVIJI I SRBIJI 1997 - 2000

Četiri prethodno objavljene Bibliografije sa indeksom citata o istraživanjima oblika spektralnih linija u Jugoslaviji, pokrivaju period 1962 - 1997. (Dimitrijević, 1990, 1991, 1994, 1997). U periodu od marta 1997. do 31. decembra 2000. godine, objavljeno je 298 članaka koji se odnose na istraživanje oblika linija jugoslovenskih (srpskih) autora. U Srbiji su takodje odbranjene i 3 doktorske i 3 magistarske teze. Shodno tome, od prvog članka u ovoj oblasti (Vujnović i dr., 1962) pa do 31. decembra 2000, objavljeno je 1427 (1222 od strane srpskih autora) bibliografskih jedinica od ukupno 179 (152 iz Srbije, 26 iz Hrvatske i 1 makedonac koji živi u Francuskoj) jugoslovenskih autora.

U razmatranom periodu istraživani su različiti problemi i objavljeno je više preglednih članaka (1128, 1129, 1131, 1133, 1137, 1139, 1166, 1167, 1290-1292, 1319-1321, 1334, 1335, 1356-1358, 1380, 1381). Štarkovo širenje linija vodonika i vodoniku sličnih emitera, posebno je proučavano u slučaju H beta linije. Razmatrani su asimetrija njenog profila (1347, 1407-1410), pomak centralnih delova (1194, 1270), teorijski Štarkovski prošireni profil (1379, 1385), njen oblik u pražnjenjima sa koaksijalnom diodom (1196), uticaj fine strukture na njen oblik u oblasti katodnog pada kod tinjavog pražnjenja (1278), primena njenog oblika za dijagnostiku elektronske gustine u oblasti 10^{20}-10^{21} m^{-3} (1317) i efekat magnetnog polja na njenu emisiju iz plazme T-cevi (1130, 1161). Osim toga, jedan članak je posvećen programu za odredjivanje elektronske gustine iz eksperimentalnog profila H beta linije (1427). Takodje su razmatrani uticaj fine strukture na Štarkovo cepanje H gama linije u spoljašnjem električnom polju (1279), karakteristični parametri profila vodonikovih Balmerovih linija u takvom polju (1351) i upotreba oblika linija atomskog vodonika za odredjivanje temperature pobudjenih atoma vodonika u tinjavom pražnjenju (1197). Štarkovo širenje He II Pašen alfa linije bilo je razmatrano u Refs. 1412 i 1426.

Rad na eksperimentalnom odredjivanju parametara Štarkovog širenja linija nevodoničnih emitera nastavljen je u razmatranom periodu. Bilo je istraživano Štarkovo

širenje sledećih atoma i jona: Ar I (1175, 1243, 1248-1250, 1252, 1322, 1328, 1329, 1331, 1386, 1395), Ar II (1315, 1326, 1327, 1332, 1395), Ar III (1315), Ar IV (1313), B II (1205), C II (1202, 1283, 1284, 1374, 1415, 1416), C III (1202, 1205, 1284, 1355, 1374, 1415), C IV (1308, 1374, 1413, 1415), F II (1283), F III (1355), He I (1386), Kr I (1386), Kr II (1388, 1389, 1391), Kr III (1390, 1391), N II (1174, 1202, 1204, 1205, 1244, 1246, 1247, 1283, 1284), N III (1202, 1237, 1244, 1284, 1355), N IV (1244), N V (1245), Ne I (1386), Ne II (1370, 1371, 1283), Ne III (1355), Ne IV (1387), O II (1173, 1202, 1238, 1283, 1284, 1324, 1414), O III (1202, 1205, 1284, 1355), O V (1245), O VI (1312), S IV (1376), Si I (1195, 1271). Osim toga, bili su odredjeni parametri jonskog širenja za Ar I (1251, 1396, 1398) i C I (1332, 1397, 1398). Takodje su bili istraživani i uticaj dinamike jona (1171), temperaturska zavisnost (1160, 1161, 1325), odstupanje od LS veze (1203) i Li-, Be-, B- i C-izoelektronski nizovi (1282, 1285, 1289, 1353, 1354), kao i upotreba relativnh intenziteta zabranjenih i dozvoljenih komponenti linija He I za merenja električnih polja (1169, 1172, 1242) i upotreba profila nevodoničnih linija za dijagnostiku elektronske gustine induktivno spregnute plazme (1167, 1168), fitting procedures for recovering the profile of spectral lines (1384) and deconvolution procedure (1253, 1254, 1333, 1378)

Koristeći semiklasični perturbacioni prilaz (Sahal-Bréchot, 1969a,b), istraživani su spektri sledećih elemenata: Zn I (1298, 1300, 1302), Ca I (1293, 1299, 1304, 1362), Au I (1341, 1342), Sr I (1156), Mg II (1218), Tl III (1224, 1229, 1304), In III (1229, 1304), Y III (1143, 1144, 1150, 1233), Pb IV (1224, 1229, 1304), P IV (1152, 1157), V V (1145, 1148, 1209), S V (1142, 1146, 1208), F VI (1226, 1228, 1235), Cl VII (1226, 1228, 1235), O VII (1147, 1214, 1222), Ar VIII (1301), K VIII (1223, 1230, 1231), Kr VIII (1296, 1297), K IX (1230, 1231, 1234), Ca IX (1155, 1216), Ca X (1151, 1155, 1216), Na X (1212, 1215, 1221), Sc X (1210, 1213, 1220), Mg XI (1211, 1214, 1222), Si XI (1153, 1154, 1217), Ti XI (1213, 1219, 1220, 1225), Sc XI (1220, 1227), Ti XII (1213, 1219, 1220, 1232), Si XIII (1149, 1154, 1217) i V XIII (1148, 1209).

Kada nije moguće upotrebiti semiklasičan perturbacioni prilaz sa odgovarjućom tačnošću, pošto nemamo pouzdane atomske podatke, korišćen je modifikovani semiempirijski metod (Dimitrijević i Konjević, 1980) koji je prikazan u preglednim radovima 1182 i 1359. Modifikovani semiempirijski prilaz primenjen je na linije Ag II (1424), Au II (1265, 1341, 1342, 1422, 1423), Bi III (1141, 1207), Co II (1350, 1422, 1423), Co III (1423), Cu III (1181, 1189), Eu II (1339, 1340, 1256, 1260), Eu III (1339, 1340), Ga III (1183, 1188), 1259), Kr II (1258, 1388, 1389, 1391, 1402), Kr III (1390, 1391), La II, La III (1185, 1187, 1339, 1340), Mn II (1180, 1188, 1259), Na II (1186), Nd II (1411), Pd II (1421), Ra II (1349), Sc II (1179), Sn II (1383), Sr III (1184, 1257), Ti II (1275), 1422, 1423), Ti III (1276), Tl II (1392), V II (1261, 1262, 1401), V III (1262, 1401), V IV (1262, 1401), Xe II, Y II (1179), Zr II (1179, 1404) i Zr III (1333, 1404).

U brojnim radovima su istraživane regularnosti i sistematski trendovi parametara Štarkovog širenja (1158, 1159, 1191. 1193, 1236, 1239, 1240, 1268, 1269, 1272, 1273, 1308-1312, 1315, 1345, 1346, 1366, 1368, 1369, 1387, 1406, 1419). Istraživane

su sličnosti parametara Štarkovog širenja u okviru supermultipleta (1158, 1159, 1236), kao i zavisnost parametara Štarkovog širenja u snopu prelaza od ostatka naelektrisanja emitera koje "vidi" optički elektron (1419), kod "off-resonance" jonskih linija (1191) i izoelektronskih nizova (1269, 1345), regularnosti Štarkovih širina duž argonovog izonuklearnog niza (1240) i u okviru Ar II spektra (1272, 1273). Koristeći regularnosti i sistematske trendove procenjeni su parametri Štarkovog širenja niza jonskih linija (1193, 1239, 1308, 1312, 1367-1369).

Astronomski aspekti istraživanja spektralnih linija proučavani su u brojnim prilozima. Istraživani su: Balmerova emisija u koronama Sunca i AGN (1200, 1201, 1418), belim patuljcima (1165) i zvezdanim flerovima (1377), modeliranje linija sa dva pika u spektrima AGN, Sy I i kvazara (1263, 1343, 1403, 1405), varijacije profila linija u Mrk 817 (1177, 1190), spectralne linije u jezgrima aktivnih galaksija (1255, 1334, 1335, 1417), Lajman alfa šuma i totalni apsorpcioni presek galaksija (1346), okolina QSO i asocirane galaksije sa prigušenom Ly alfa (1348), difuzne trake u medjuzvezdanim spektrima i fulereni (1138), doprinos medjuzvezdane materije širinama Ca II linija u spektrima zvezda kasnog tipa (1163), promenljivost profila linija kod neradijalno pulsirajućih Be zvezda (1164), cirkonijum konflikt kod odredjivanja obilnosti (1337, 1361, 1404), mehanizam Štarkovog širenja u zvezdanim atmosferama (1264, 1394), hromosfersko ponašanje Mn I 539.47 nm spektralne linije (1133), spektroskopska merenja za vreme pomračenja Sunca (1352), uticaj instrumentalne funkcije Beogradskog sunčevog spektrografa na profile linija (1199) i rešavanje neravnotežnog (ne LTE) prenosa zračenja metodom iteracionih faktora (1132). Rad na formiranju baze podataka BELDATA za parametre Štarkovog širenja spektralnih linija i spektre galaksija sa aktivnim jezgrima (AGN), takodje je u toku (1338, 1359, 1393).

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